THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. Berly's).

1913 EDITION

In Preparation.

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1872—1912.

JUST 40 years ago to the very day—November 15th, 1872—from beneath the shadow of St. Paul's and within a stone's throw of the very place where these lines are now being written, there was "launched into the waters of scientific literature a new barque,"—a modest, unassuming, yet confident and determined little pamphlet of 18 pages ($6\frac{1}{2}$ in. × $9\frac{1}{2}$ in.) of editorial matter. Amid the good wishes of a number of men of eminence in those days it started out upon its voyage, and to-day, after most of those voices have become silent, it continues on its way, still fulfilling the purpose for which it first set out.

Issued first as a monthly paper, it became a bi-weekly in six months, and so appeared until a few years later, when, launching further out into the deep, it became a "weekly," of exactly the size of page on which these words are printed. In the words of its founders, "the applications of electricity had no special organ" then, and it was their intention to meet the want. Thus it has come about that, from 1872 until now, the ELECTRICAL REVIEW has been published regularly without intermission.

With most of us there are periods of life when we sit all-pensively looking backward, and the very atmosphere becomes filled with multitudinous forms and memories. We may be pardoned if, as a paper, we confess—in recalling our birthday—to have let the pensive spirit indulge her fancy. For, after all, papers are at heart really men—like men they breathe, speak, remember—do they not carry the thoughts, and even voices, of ten thousand minds, and hold them, perhaps still full of their old eloquence and verve, in the recesses of Time?

Recollections will crowd upon us of those early days, and of the intervening years—we cannot keep them back—recollections of the men who were in electrical science and industry at their very birth, and associated themselves with this journal when the old 'bus horse still took its measured tread, the aviator had not circled the Cathedral dome, nor had tubes pierced the bowels of London. We recall men who, though those were days of strain and vicissitude with us, had so confident a belief that that little publication had entered the field at the right time, and that a great future was in store for it, that they stood by it with sympathy and constancy. Those early workers have, one by one, passed out of this sphere of small affairs to more peaceful shores, and of those who know the inner history of the early building-up of the ELECTRICAL REVIEW and the sacrifice it compelled to some, but few remain. Distinguished among these is Sir William Preece, who, on a following page, is kind enough to wish us "Many Happy Returns."

Not many copies of the first volume are now extant, but those who have access thereto will find it interesting to compare the programme announced by the founders in simple but definite terms, with the tone and policy of the journal during the intervening years and the character of its

contents to-day. Mark the courage of those present at the launching of that little barque of 1872! They had a "determination to overcome any opposition that might present itself." We have consistently endeavoured discreetly to continue that self-same policy, time and time again being called upon to "keep our end up" against schemers and charlatans and envious scribes, either with our pen or in the Courts, or by the adoption of a strong persistent attitude against everything that we suspected would belittle or besmirch electrical interests, or obstruct the progress of those associated with their conduct.

Many a sprightly stripling has since started out on similar purpose bent, but we have never had any reason to do other than wish them well. To quote again the foreword of our first number:—"Experience may prove modification to be desirable, and we shall gladly profit by the teachings of experience." We have always striven to adapt ourselves to the varied changing conditions of forty years, and in the course of our close observation of the doings of contemporary journals few things have stood out so plainly as the manner in which our arrangements, sections, and so forth have been followed. But on such an occasion as our birthday, how could we bring this thought to mind with any idea other than to raise a smile, and not to wound, for may not emulation of ourselves naturally draw from us satisfied and amused congratulations? Suggestions innumerable have been received respecting measures that we might adopt for meeting some detailed or local requirement or fancy. For all these good intentions we are grateful, for we are always glad to be kept closely in touch with the life and needs of the reader; it is not our practice to cast aside any proposal without weighing it in the light of prolonged and close experience of what the majority at home and abroad require. If the reader has been impressed with something in a contemporary that he thought we might imitate, either by way of frivolous jest or peculiarity of style, he may be pretty sure that there is a very good reason why it is in his own interests for it to be absent from the Electrical Review.

If we take pride in one feature more than another, it is, perhaps, in the continuity of proprietorship and editorial and business *personnel* of this journal—a feature which naturally has made for continuity of policy, both in our pages and in our relations with the industry.

We will resist the temptation to indulge in detailed reflection respecting the changes that have come over electrical science and engineering between 1872 and 1912, new developments following with swift-winged feet upon each other, for our readers are all busy with the affairs of to-day, and we ourselves have a journal to produce. Necessity reminds us that "life lies in the future, and not in the past," and we re-echo the words of our predecessors, and say that we are to-day ready as a journal for whatever the years may bring.

The early craft was launched upon an unknown and a troublous sea, and for 40 years that vessel has weathered the storm. We stand to-day—experienced pilot and hardy crew—prepared for any emergency that may arise in service to the industry, assured that with the continued co-operation and harmony prevailing within, and continued support from the leaders and the rank and file of the profession and industry, we shall be able to assist in promoting the best interests of all.

A Coal Engine.

The article which we publish in this issue describing a gas engine which is its own gas producer calls up an interesting picture of what we may yet see in the central station—a row of gas engines with a coal conveyor passing over their hinder ends, and supplying them with small or granulated coal. The picture is not one that will delight the station superintendent, who takes a pride in his humming turbines and spotless engine room, but æsthetics in the power house must necessarily give place to economics.

Is there not in this invention a useful hint for the inventors of gas turbines? One of their difficulties is to get the gas into the combustion chamber, which necessitates the use of pumps; if they can inject it in the solid form, *i.e.*, as coal, they will be relieved of this trouble at least, though they will still have to pump the air in.

The coal engine is really a natural development of the oil engine, and the idea, at least, is old; we remember an engine fed with powdered coal at the Glasgow Exhibition of 1901, made by Messrs. Stewart, but it was not a success. However, that is no reason why the present attempt should fail, and we shall observe its progress with interest.

"A Little Knowledge."

The inquest which took place last week on the death of Mr. J. C. M. Thompson in an electric bath, once more exemplifies the danger of playing with such edged tools as is the electric current, without skilled supervision. So far as the unfortunate victim of the accident was concerned, his action in taking the electric bath was innocent, and we could not reproach him even had he not paid with his life for his harmless indulgence; he had experienced good effects from the treatment, and he could not be expected to question the competence of the proprietors of the baths. But it cannot be too widely known that the electric current in its therapeutic applications, while capable of conferring immense benefits upon mankind when properly applied, is dangerous in unskilled hands. The words of the bath attendant, as reported in the daily Press, tell their own tale to any technical man:—"Through the water he administered an electric current of 400 milliwatts, which was equal to 10 volts, but only about 2 volts would go through the body." What could be more utterly nonsensical?

The facts appear to be that a current was passed through the water in the bath in series with an incandescent lamp, fed from the public mains at 240 volts; obviously a short-circuit in the lamp or the lampholder would immediately throw the full voltage upon the bath, and the patient lying in the water would be in an ideal position to receive a fatal shock. The precaution that was suggested, of substituting a number of small lamps for the single one, is quite inadequate; if the lamps were in parallel, it would multiply the risk, and if in series, there would still remain the fact that on a three-wire system, with the neutral earthed, the lamps might be inserted on the neutral pole, and the patient would be liable to receive a fatal shock between the live electrode and the waste pipe or the supply pipe.

The use of current from the main in this manner is clearly dangerous, unless suitable precautions are taken, and ought to be prohibited.

That ignorance still prevails regarding the danger of a shock from lighting mains is well illustrated by the evidence of an "inspector of installations" reported in our "Notes" to-day; he thought it impossible to be killed by a 200-volt shock. Yet readers of the Electrical Review are well aware that several cases have been recorded in our pages where death has resulted from a lower pressure than 200 volts.

MANY HAPPY RETURNS.

By SIR WM. H. PREECE, K.C.B., F.R.S.

The Electrical Review made its first public appearance on November 15th, 1872, exactly 40 years ago, as the *Telegraphic Journal*. In the following January were added to that title the words "and Electrical Review." I took a keen interest in the paper and for a short time edited it, but the transference of the telegraphs of the country from private companies to the State threw such a burden of work upon my energies that I had to clear away all other work. My telegraphic career commenced in 1852—60 years ago! In 1863 I married, and spent the honeymoon in Paris in a new splendid hotel (the Grand Hotel), which was the first building fitted up with electric bells by Breguet. It tempted me to write a series of articles upon the practical applications of electricity, describing Breguet's system. This attracted the attention of Sir James Truscott, who had just purchased a house in Park Crescent, Regent's Park, and determined to fit it with electric bells. There was no firm in London to undertake the job, so the apparatus complete was obtained from Breguet, and fitted in Park Crescent by two of my telegraph men employed in Southampton, under the direction of a man from Paris.

This was the commencement of the electrical era, which has since grown to such gigantic proportions and in such numerous directions, that the simple system which rang "the tocsin of the soul, the dinner bell," now records on the earth ethereal disturbances in the sun itself. In 1872 the applications of electricity were growing fast in number and importance, so that a periodical journal dealing with all branches became imperative, and the Electrical Review was launched under the title—The Telegraphic Journal and Electrical Review. The first part of the title was abandoned in December, 1891.

In the first number there were 18 small pages of printed journalistic matter. In the last number (November 8th) there are 44 larger pages. In the first number there were six pages of advertisements—in the last number 80!

The year 1872 saw the birth also of the Society of Telegraph Engineers, and the first number of the Review reports the seventh ordinary meeting of that Society under the first President, Sir William Siemens, when a paper was read by W. H. Preece, Esq., on "Lightning and Lightning Conductors." Curiously enough, it was also the year of the birth of that eminent electrician who now occupies the chair—probably our youngest President—of the Institution of Electrical Engineers, as it is now more properly called.

The prominent electrical industries in 1872 were electro-plating and the electric telegraph. What progress has since been made is all duly chronicled in the succeeding numbers of the Electrical Review, and thus your paper becomes a complete historical record, not only of the growth of the practical applications of electricity, but of the science itself upon which these industries are based. It indicates the rapid rate at which the electrical profession has risen to its present prominent position. In 1846, when the first Electric Telegraph Company was inaugurated, the only electric patents existing were those of Elkington for electro-plating (1840), and Cooke & Wheatstone's Telegraph (1837). The Electric Telegraph Co., however, made very small progress in the first few years of its existence, and it was not until Robert Stephenson, George Parker Bidder, and Edwin Clark joined the company in 1851 that it commenced to flourish and to go ahead.

Again, from the original company itself sprang the British and Irish Magnetic Telegraph Co., under the guidance of Charles Bright, and the United Kingdom Telegraph Co. under that of Andrews. Thus commercial rivalry ensured commercial progress in the same way that this progress had already increased the literature of the subjects upon which the industry was based. The growth of the industry as well as that of the Review went steadily on, and in all countries throughout the world the same causes have led to the wide distribution of these industries.

The Electrical Review led to the introduction of the *Electrician*, in 1878, the *Electrical Times* (which was first known as *Lightning*), *Electricity*, and many others at home, while in the United States the *Electrical World* and several other electrical papers flourish as much as our periodicals are flourishing at home. Indeed, there are many of us who find that there are too many publications pouring in upon us every week. Those who are in the van of the business have to study not only the running journals, but also the solid scientific work which is done by the Royal Society, the Physical Society, and other scientific gatherings. Based on the growth of the science, other Institutions and Societies are springing up all over the world. Thus electrical literature and electrical science are growing at lightning speed everywhere.

The activity of the workers and the publication of their works by the literature of the day, as well as the public utility raised by these inventions, have led to a very full and complete system of advertising. Indeed, advertising in these papers has become not only quite a science of its own, but also a necessity for those who are manufacturers and for users who have to pay as much heed to the advertising pages as to the literary pages. Manufacturers themselves must find this growth of advertisement a very considerable source of expense, but while it maintains and tends to maintain the publications in full swing, the public and the scientific world ultimately gain. We now can know everything that is original or novel, and we learn all the advances made in the growth of our science. The life of the Electrical Review is a history of the life of the electrical industry.

There is one point connected with the Review that is very marked—its unwavering adherence to the policy with which it set out when inaugurated in 1872, and which it has maintained to the present day. It caters for all branches of the industry and all classes of the science, but far more than that, we learn of the legal aspect of all the disturbances that arise, and can follow as well the finance of the question and the value of stocks. The proceedings of the innumerable institutions all over the country are published and we learn of the advances made by the municipalities, by the railway companies, and by the various branches of the industries of the country, and we learn, not only the history of what is going on in our own country, but also of the progress in every other country, and above all in the Colonies and outlying branches of the British Empire.

I must congratulate the Editors and Proprietors of the paper upon the position that they have so well maintained, and I trust that I may live long enough to compliment them at some future day on the jubilee of their achievement.

HONG KONG UNIVERSITY.

Since the publication of our last issue we have received from Prof. C. A. M. Smith further particulars regarding the needs and aspirations of the University, together with a photograph, which we reproduce herewith, showing the building as it actually appears. Already there are 35 first-year engineering students—an excellent start; the Chinese are determined to go in for Applied Science, and Prof. Smith believes that if the laboratories are properly equipped there will be at least 250 engineering students in four years. These men will be eagerly snapped up as soon as they have completed their engineering training by Chinese firms developing the resources of their country, and will thus become pioneers and leaders in the native industries; if we choose, by making them acquainted at first hand with the high qualities of our apparatus and machinery, we can make them also invaluable channels for our exports to flow into that vast and virgin area.

Prof. Smith informs us that the University has already received offers of help from enterprising German and American firms, but—as yet—nothing from home; no one ever caught our German or American friends asleep in such a matter, or found them indifferent to, or lacking appreciation of, the immense importance of training the young engineer on the lines most profitable to them, and if our firms are not wide awake, they will lose a unique opportunity, such as may never recur. The University has been founded in the interests of British trade; Prof. Smith is there to help British firms, and wants to have everything British; the laboratories of the University will be first-class showrooms, visited not merely by the students, but by everyone who visits Hong Kong, which is the only British Colony in the Far East; students are already enrolled from the Straits Settlements, Canton, Fuchow, &c., and will carry their impressions of the machines in the laboratories over an immense area. Let us see to it that those machines are all British, and of the first quality; it will be one of the finest investments conceivable.

A British engineering firm of Tai Koo gave no less than £40,000, without which it would have been impossible to commence the University. We are morally bound to support that excellent lead, which in itself proves that there is abundance of trade awaiting us out there. Now let us do our share, and do it well—and, above all, quickly.

We have received from Prof. Smith a list of the apparatus required in the mechanical, electrical and civil engineering departments, which we print below, and we shall be glad to place on record the donations which we confidently anticipate.

List of Apparatus Needed.

Mechanical Engineering Department.

Heat Engines Laboratory.—(1) All kinds of oil engines, to use crude or refined oil, up to 10 H.P. An opportunity to exhibit engines suitable for motor-boats or electric lighting plants; (2) A gas engine and gas producer. The engine to have coupled to it a generator, D.C, 20-KW., 110 volts; (3) Small exhibition sets, steam turbines, say, 5 to 10 H.P., with condensing plant if possible; (4) Refrigerating plant; (5) A small oil-fired water-tube boiler; (6) Indicators for steam and gas engines; (7) Condensing plants; (8) Ganges; (9) CO_2 recorder; (10) Calorimeters; (11) Injectors.

Workshop.—(1) Small lathes; (2) Drilling machine; (3) Planing machine; (4) Small tools; (5) Any measuring appliances.

Electrical Engineering Department.

(1) Ammeters, voltmeters, wattmeters, range 50 amperes, 500 volts; testing sets generally; (2) Motors and generators. Motors of about 5 H.P. desirable; (3) Switches and switchgear; (4) Transformers (about 5 KW.); (5) Rheostats; (6) Telegraph and telephone apparatus; (7) Samples of wires, cables, and fittings generally; (8) Photometric apparatus.

Civil Engineering Department.

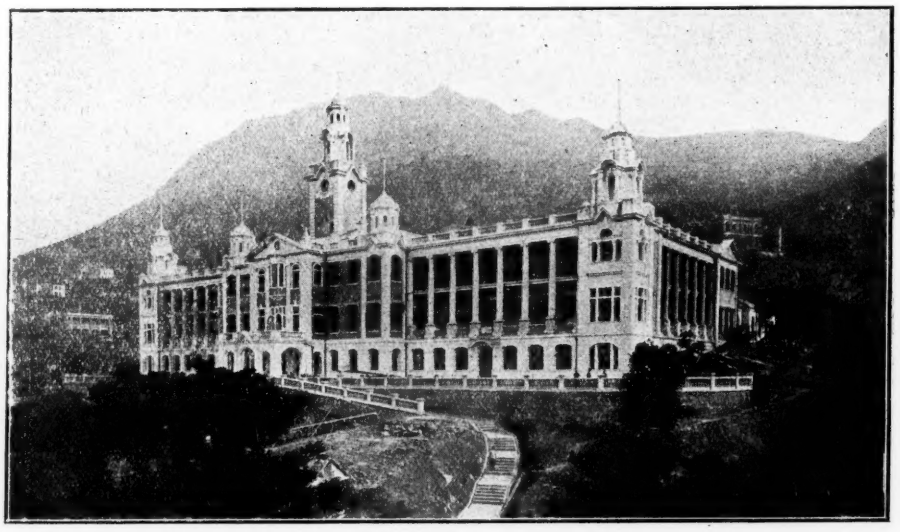
Strength of Materials Laboratory.—(1) A 10-ton testing machine; (2) Wire-testing machine; (3) Cement-testing machine; (4) Extensometers; (5) Hardness-testing appliances; (6) Impact testing machine; (7) Apparatus suitable for microscopic study of metals.

Hydraulics Laboratory.—(1) Centrifugal pumps up to 5 H.P.; (2) Pelton wheel up to 5 H.P.; (3) Turbines up to 5 H.P.; (4) Water meters; (5) Plunger pumps.

NOTES FROM CANADA.

[From our own correspondent.]

The accompanying curves (p. 777) illustrate very clearly the imports of electrical apparatus into Canada, both as regards actual values and the relative proportions.



Hong Kong University.

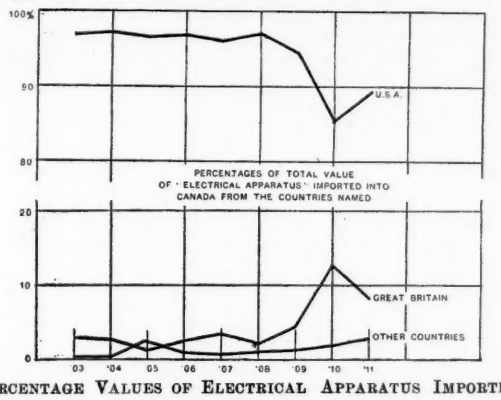
The most striking feature is, of course, the enormous lead which the U.S.A. have obtained over the rest of the world; for Great Britain the most satisfactory one is that while the total imports of this class are increasing at a tremendous rate, the Old Country is securing an increased percentage (see percentage curves) even in the increased import values; and seeing that the import trade of "Other countries" is, so far, almost negligible, it follows that the percentage values of the imports from America are falling in almost the same ratio as the British ones are rising.

As real efforts to secure a share of Canadian trade have only been undertaken during the last three or four years, it is evident that these efforts have been so rewarded as to make the outlook encouraging, and it will be extremely interesting to watch the results of the next few years.

During the nine years represented in the curves Canada's own producing ability has steadily increased, as is proved by the fact that her exports of "electrical apparatus" have multiplied sevenfold; but the fact, already stated in these notes, that her imports are bound to increase at a great rate for many years to come seems evident from a consideration of the Trade Returns, for, as yet, the value of her exports (of "electrical apparatus") is only about one-hundredth of that of her imports; it will, therefore, be a long time before she can keep pace with her own requirements.

An incident which came under the personal notice of the writer only a few days ago is worth relating here.

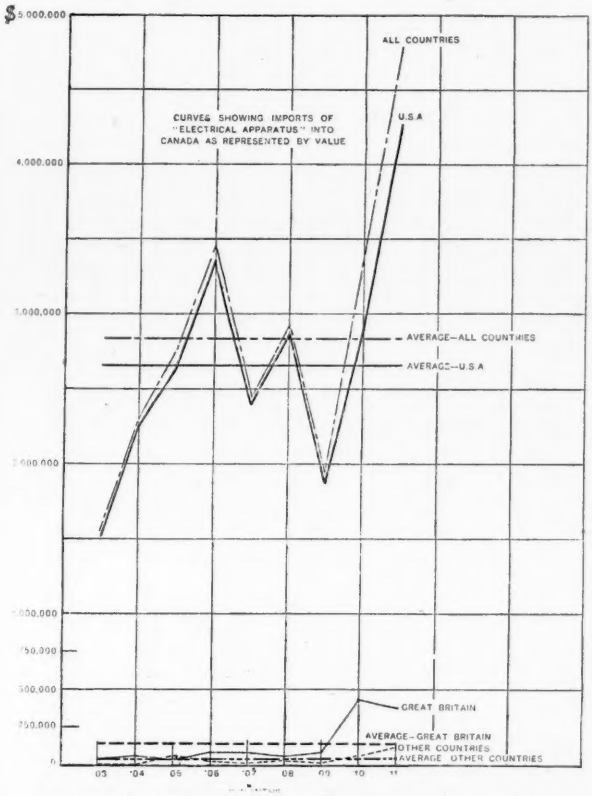
The manager of a factory was discussing, with a couple of electrical engineers, the question of installing electric motors, and was quite evidently in favour of purchasing them from a British firm; knowing nothing of motors himself, he sought advice on this question, and was strongly advised against buying from Great Britain, as the engineers in question considered that motors made there were not so strongly made as those obtainable on this side of the water,



Percentage Values of Electrical Apparatus Imported into Canada.

the efficiency was admittedly slightly higher, but the air gap was so small and the bearings, &c., had so little metal in them, that troubles were soon apparent, owing to the rotor rubbing itself to pieces on the stator and other direful happenings, and that British motors were best left alone.

The writer believes that the foregoing statements were made not out of any antagonism to British machinery, but due to complete ignorance of it, and a fear of recommending



Curves Showing Values of Electrical Apparatus Imported into Canada.

some unknown, and by the engineers referred to, untried articles; had the British motors been better known, there is not much doubt that the manager of this factory would have gone away with the impression that Old Country motors were at least as good as those to be had over here, and would in all probability have sent his order there, whereas it is not at all likely now that he will do this. Cases similar to the foregoing, no doubt, arise very frequently, and end in a like manner, and it behoves home firms to bestir themselves to make their products better known.

CONSULTANTS v. CONTRACTORS.

A second edition has recently appeared of a popular handbook on electricity, in which the author, a consultant, reprints a reflection on contractors which appeared in the original edition. He says, in effect, that any householder considering the question of an electrical installation, big or little, in town or country, should employ a consulting engineer, as no contractor is to be trusted to carry out a satisfactory installation without supervision. This statement is made without any qualification. He might, with some truth, have said that some consultants are more to be trusted in the preparation and carrying out of an installation than some —or even many—so-called contractors. But so mild a statement would not have served his purpose—of bringing grist to the mill; and readers of his book are, therefore, left under the impression that *all* electrical contractors are cheats and rascals without engineering knowledge, who will charge him an extortionate price for bad work, and that salvation is only to be obtained at the cost of 5 per cent. and expenses to *any* consultant.

So broad an indictment is as unjust as it is obviously foolish. A better case, indeed, might be made out for the reverse proposition—that a man contemplating an electric installation will be better served by putting his work in the hands of a good contractor than he will be by employing any consultant. He will obtain a more modern and efficient installation, at something like two-thirds of the price, to say nothing of the 5 per cent. and expenses. More generous than the author referred to above, I will qualify this statement; for there are certainly some consultants—most contractors in a large way of business will be able to count them on their fingers—who do know how to specify a sound, up-to date, installation. But there are none who can, or will, specify an efficient job, as cheaply as can an experienced contractor.

The reason is not far to seek. The consultant has not the inducement to economy that a contractor has. Apart from the lure, unconscious perhaps, of the 5 per cent., the consultant has no check on his fancy for expensive gear, beyond, may be, the generous approximation with which he has furnished his client. The contractor, on the other hand, is preparing his own scheme, and knows that he is probably in competition with others, and that it is up to him to keep his price down to the limit, unless he can show his layman client obvious value for the increased expenditure. The natural result is that the successful competitor provides his client with full value for his money: with an installation which, if he be a good contractor with a reputation to sustain, will be entirely satisfactory in capacity and efficiency.

The consultant has no such inducement. What consultant, to take a typical example from actual experience, would advise a client requiring an installation of about 40 lights to have a small petrol-electric plant put down which, with wiring and extras all told, only cost £130? Absurd! Too small and cheap! Bound to give trouble! Yet, as a matter of fact, the battery only requires charging twice a week in winter; the running costs for a year are only 70s.; and not a penny has been spent on repairs since the plant was put down.

Another case. Some time ago I submitted a scheme and an estimate, in competition with two others, for a fair-sized country house installation. The owner of the house, perplexed perhaps by conflicting schemes and costs, called in a consultant, who sent the three original tenderers his specification, in which I, for one, had the pleasure of recognising the main lines of my own scheme. But, thanks to the consultant's fancy free, the contract, happily secured at last, works out at over £1,000 instead of the original £600, although the battery capacity, the horse-power of the engine, and the total number of lights are practically identical.

A contractor gives the essentials. A consultant adds the generally unnecessary luxuries. He specifies marble bases to his fuseboards, and real ivory labels. He will want two voltmeters where the contractor would use one with a voltmeter switch. He will work in a booster, where the contractor who knows his business will put down a smaller generator and a larger battery. He will—or, perhaps, it would be fairer to say he did for at least two years after

metal lamps were on the market—base his calculations on the use of carbon lamps. He revels in complicated switchboards performing all sorts of unnecessary functions. His main cables invariably have 100 per cent. overload capacity with a no-volt drop, although it is quite time he learnt that no respectable country house ever has more than half the lights on at once. And, generally speaking, he uses the Institution rules with a constant factor of 2 against the contractor. Indeed, there is hardly any imaginable folly which some who call themselves consulting engineers do not commit at the expense of their clients. This very week I have seen a specification in which it is stipulated that every one of some 600 switches shall be furnished with hammered oxidised silver covers, at a list price of 1s. 9d. each—for a workhouse!

To put it plainly, a man contemplating an electric light installation will find that in all cases a consultant is expensive, in most cases unnecessary, and in some cases incompetent. Some of them are ex-contractors who have failed; others are men who have had technical book training and no practical experience. Nearly all are out of touch with current practice. This is not to be wondered at. The average consultant, particularly in the provinces, is happy if he draws commission on half-a-dozen contracts in the year. The whole experience of many of them is limited to, say, a score of installations.

Contrast that with the experience of the despised contractors, who, the public are told, are not to be trusted to fix a ceiling rose except under the eagle eye of a 5-per-center or his half-baked draughtsman.

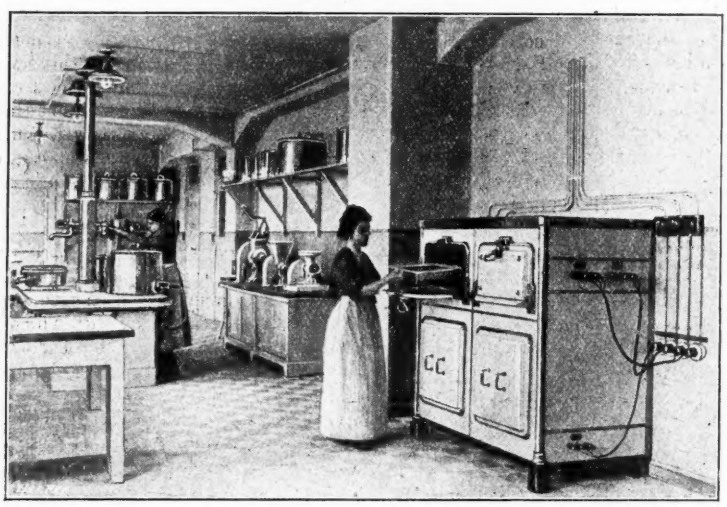
A dozen of the leading firms, known to every one in the trade, can count their hundreds of installations, going back to the "eighties"; installations of every size and description in every part of the country, while many of the individual employés of these firms, and many other of the smaller contractors, can reckon up their "century" of plant jobs. How can any consultant venture to pit his knowledge and experience against the accumulated knowledge and experience of such contractors as —— or ——? (Readers can fill in the blanks for themselves.) Yet our audacious author tells his public they are not to trust such firms. They may know, he says in effect, what they ought to do, even better than I, but do you really think they will do it, unless I keep my eye on them? But it is surely obvious that to firms such as these, whose names are household words, their reputations are their most valuable asset, and they cannot afford to save a few pounds by scamping their work, at the risk of losing a potential recommendation.

It need scarcely be said that none of the foregoing remarks apply to the big Westminster consultants and their like, who, for the most part, do not touch lighting work, and who fill a definite and valuable *rôle* in the electrical world. And of the other consultants who specialise in lighting, there are certain honourable exceptions to the general rule, that a consulting engineer called in to prepare a lighting specification doubles the cost and halves the efficiency. For the ordinary country house or private residence, a consulting engineer is absolutely unnecessary.

Let the householder wishing for a good installation only use the same common-sense that he applies in choosing his milkman, his builder, or his doctor, and choose a contractor who is a contractor only, and not a plumber or an ironmonger—he would not trust his affairs to a lawyer who kept a fried-fish shop—a contractor with a known reputation, recommended to him by his friends, and he may be confident that any work entrusted to such a contractor, with or without competition, will be carried out at least as efficiently, and certainly more economically, than it would be under any consultant.

Let him remember, too, that however good a consultant's specification may be, the merit of carrying it out properly is ultimately with the contractor. Whatever he may pretend to the contrary, no consultant can adequately supervise a job he only visits at intervals. His inspections and tests are, in most cases, mere farce. There are few consultants whom an intelligent foreman cannot hoodwink—and he often does. He dare not, and generally cannot, hoodwink his employer, who is a practical man like himself, if he is the right sort of contractor. There are black sheep in both folds; the layman runs at least as much risk of choosing a bad consultant as of choosing a bad contractor. Somewhat more, to tell the truth: apart from the fact that he is more likely to be in closer touch with contractors, as a class, than with fifth-floor-back consultants.

In fine, the average contractor is not the potential criminal which consultants' specifications assume him to be; he is, at least, as fair and honest as they, and not seldom more able.—H. R. T.



Electric Kitchen at Messrs. Siemens-Schuckert's Cable Works.

MESSRS. SIEMENS-SCHUCKERT'S ELECTRIC KITCHEN.

[by our Berlin correspondent.]

The present tendency to transfer large engineering works to the periphery of cities entails a number of economical problems, foremost among which is the provision of a mid-day meal for the employés. Special restaurants with electrically-operated kitchens have therefore been installed in many cases, the electrical energy being available at cost price or at an extremely low rate.

An interesting electric kitchen of this kind has been recently installed at Messrs. Siemens-Schuckert's new cable works at Gartenfelde, near Berlin. This kitchen, which is designed to supply about 300 people, comprises:—

Eight pans, each of 15 litres, consuming	... ...	2·6 KW. each
Eight pans, each of 35 litres, consuming	... ...	4·2 ,, ,,
Three round frying pans, 35 cm. in diameter	...	2·2 ,, ,,
Three square frying pans, 40 × 25 cm. diameter	...	1·32 ,, ,,
Three square frying pans, 50 × 34 cm. diameter	...	1·76 ,, ,,
Two stoves directly connected with two heating cabinets, with a total consumption of	... ...	15 ,, ,,
One coffee machine of 35 litres capacity, using about		1·7 ,, ,,
One water kettle for same, of 35 litres capacity	...	3·8 ,, ,,

as well as various smaller pans, all of which were supplied by Messrs. Prometheus, of Frankfort a/M—Bockenheim. The total power consumption of all the apparatus would, at maximum load, be 95 KW. The average consumption, however, is considerably lower, the various apparatus above enumerated never being heated all at a time.

The pans are of a substantial and pleasing design, with double nickel-plated walls, designed for separate bottom and side heating, controlled in four steps. The round pans contain steel sheet vessels, whereas the square pans are made of non-oxidised iron castings. The stoves and heating cabinets are arranged either beside or above one another, thus reducing heat losses by radiation to a minimum; the outside walls are lined with white enamel, and the fittings are nickel-plated. The stoves are designed for both top and

bottom heating, and are controlled separately. The coffee machine is combined with a coffee kettle kept permanently warm by the electrically heated water bath. The kitchen table is built of stonework covered with enamelled plates.

The flexible cords are arranged in a most convenient manner, being immediately at hand for use. Separate switches have been inserted in the various conductors, so as to reduce the wear on the contacts and in view of the considerable current intensities in all the larger apparatus. Slewing taps are arranged on a nickel-plated column in the middle of the kitchen table for supplying water to the pans.

All the auxiliary machinery is, of course, likewise operated by electricity, the kitchen being excellently ventilated by electric fans.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Speed of Signalling through Submarine Cables.

A paper by Mr. R. Appleyard in the Civils' *Proceedings*, Vol. CLXXXIV, describes an instrument for use in certain calculations relating to the speed of signalling through submarine cables. The same calculations can be done easily on an ordinary slide rule, with the accuracy specified in the paper cited. The slide rule has an additional advantage, that *the percentage error of reading is uniform throughout the scale.* This fact is not so well known, either by makers or by users, as it should be.

As an example of some of the many uses to which a slide rule can be put, it may be worth while to show how the calculations referred to in Mr. Appleyard's paper can be solved on a slide rule.

The main problem is to make a suitable selection of the innumerable possible pairs of values for D and d that suit a given value for $\log_{10} D/d$, where D is the diameter of the dielectric, and d the effective diameter of the conductor, both in mils.

Let $x = \log_{10} D/d$; then if $d = 10$, D is the antilogarithm of x. Set against the indicating mark, which is generally found in a little recess at the back right-hand end of most slide rules, the value of x read off on the uniformly divided scale marked along the middle of the back of the slide, and turn the rule face up again, when all suitable values of D and d will be found facing each other along the bottom of the slide rule.

Thus if $\log_{10} D/d = \cdot207$, we find the antilog of $\cdot207$ is $1\cdot611$, showing that if $d = 10$, $D = 16\cdot11$: and without any further shifting of the slide, we read off at once the following pairs:—If $d = 250$ mils, $D = 403$ mils; if $D = 500$ mils, $d = 310$ mils; and so on.

The capacity in microfarads, and the dielectric resistance in megohms per nautical mile, can also be obtained on a slide rule, using the simple formulæ given in the paper, viz., $r = 0\cdot1582 \div x$, and $z = 549\cdot8 \times x$; while the weight and resistance of the conductor and the weight of the gutta-percha can be obtained from the following formulæ, which have been deduced from the data shown on the drawing accompanying Mr. Appleyard's paper.

Weight of conductor per N.M. $= 0\cdot0145\ d^2$ lb.
Resistance of " " " $= 83{,}250 \div d^2$ ohms.
Weight of gutta-percha " " $= 0\cdot002076\ (D^2 - d^2)$ lb.

C. L. T. Griffith.

Madras, *October 24th*, 1912.

Motor-Hiring at Leeds.

The reference in your last issue to the Leeds Corporation motor-hiring proposal appears to have been made without a very clear knowledge of what has actually occurred, and the writer, who has had the privilege of dealing with most of the correspondence on the matter, ventures to think that if all the facts were placed before your readers, they would be convinced that the scheme fully deserved at any rate the temporary check which it has received.

In the first place, several of the leading electrical motor manufacturers in Leeds, including those most likely to be affected by it, knew nothing at all of the proposed scheme until within two days of the date when its sanction was to have been obtained from the City Council. The position with regard to the contractors was also very little better. Those who did know anything with regard to it had had vague promises of wiring held out to them, and at the same time had most carefully been told that the proposal was for the hiring of motors only, and that it did not in any shape or form permit of the actual sale of electric motors. The surprise of the contractors may, therefore, be imagined when they found that the following clause was included in the minutes to be passed by the Council:—

(*e*) That any hirer be permitted to purchase the motor hired to him at any time, at a price not lower than the net figure at which it stands in the books of the Corporation, and that the manager be and he is hereby authorised to sell such motors accordingly.

It need hardly be added that this clause aroused misgivings, for, in spite of all assurances to the contrary, it was felt that the scheme did really include the sale of motors, and that it would at any rate make it almost impossible for anyone else to sell motors in Leeds. After all, when it is looked into closely, this question of hire-purchase or sale almost resolves itself into the proverbial distinction without a difference.

At any rate, in order to avoid the litigation and trouble that has occurred at Leicester and Sheffield, prompt efforts were made to stop the scheme before it could pass the City Council, and after being sent back once, to save a second defeat at the same hands, the scheme has now been referred back by the party who originally brought it forward themselves, excuse being made that they wish to discuss the matter with the local firms.

That this wish for discussion is the merest excuse, will be gathered from the fact that already on two occasions deputations, including five or six principals from the firms interested, had attended on those responsible for the scheme, but the statements then made, and confirmed in writing, showing that the demand for motors on the hire and hire-purchase systems is adequately supplied by a number of firms in this city, have throughout been utterly ignored. Also, on the last of these occasions when we attended a meeting of the Electricity and Tramways Sub-Committee, which comprised two of the Labour Councillors, the Deputy-Chairman, Mr. Robert Armitage, M.P., and the Manager of the Electricity Works, Mr. Harold Dickinson (who was present *ex-officio*), no adequate discussion was permitted. The Deputy Chairman made a statement to the effect that the Corporation proposal related purely to the hiring of motors and had nothing whatever to do with the sale of motors or any other apparatus, or with the wiring. All attempts at discussing these aspects of the matter were at once silenced and ruled out of order.

To return to the position of the contractors, wishing to know their exact feelings in the matter, letters were sent to nearly all the branch secretaries of the E.C.A. in the northern towns, and numerous replies were received all showing the strongest desire that everything possible should be done to oppose the municipal scheme. There is really no question as to the wishes of the individual contractor on the matter.

In the letter to the contractors it was stated that:—"The powers under which the money is to be borrowed include specifically for electric fittings, and there is apparently nothing to prevent the Corporation from carrying out its own wiring if at any time it chooses to do so. It must be remembered that, although made in perfectly good faith, any understanding between the local contractors and the electricity undertaking on this point must necessarily be of only a temporary nature, liable to be changed with change of office, and with the sway of political power in the city."

Your readers will understand that this was not an idle word of warning when they hear that since the date of the letter, the manager of the electricity works, Mr. Harold Dickinson, on whom alone the contractors of Leeds were willing to place any reliance for the fulfilment of promises, has received an improved position as manager of the Liverpool undertaking. The party on the City Council bringing the scheme forward also lost its majority in the November municipal election. The contractors do not know who is

going to be manager of the Leeds electric light and power station in the coming year, and, apparently, it is very doubtful whether we are even to have a duly qualified electrical engineer at the head of affairs.

On glancing through your article I find that mention has been made to the hiring out of gas stoves. Well, exactly the same point was brought forwards at Leeds, but it was stated authoritatively before the City Council that the Corporation were now losing thousands of pounds a year at this business. It was also vouched for at a meeting of the Chamber of Trades that there were thousands of obsolete gas stoves in the empty houses of Leeds not worth removing, but still figuring on the Corporation books. Really, this hiring does not seem such a good wrinkle to take from our gas friends, after all.

Henry S. Ingleby,
INGLEBY & CO., LTD.

Leeds, *November 5th.*

The Lighting of Bakers' Ovens.

As a reply to the query of "Blight" in your journal this week, we venture to offer a simple solution to his difficulty. Use the ordinary lamp that has an Edison screw cap, and place it in an air-tight fitting, the usual stock article to be had from all the leading houses. Then fix this to a swivel bracket made of barrel of the necessary dimensions, and wire the same with flexible copper conductors, either asbestos-covered or copper strands insulated with beads, in the same manner that many of the elements of heating apparatus are connected up. The mere fact of the lamp being screwed into position and not being held rigid by means of the plungers as in bayonet holders will minimise danger from parts coming unsoldered, as they will not be under any strain, if the solder does go. Also the encasing effect will save the actual lamp itself from the effect of such high temperatures.

A. C. Hands.

London, E.C., *November 9th*, 1912.

Your correspondent, "Blight," would do well to scrap the gas fitting to which he refers, and try asbestos-covered flex. inside a flexible metal tube, about 3 ft. 6 in. long. To this can be fitted a backplate and an ordinary bayonet lamp-holder, a 16-C.P. carbon-filament lamp and a wire guard, no part of which should be soldered. The lamp should have good clean contacts, with a minimum of solder.

The backplate can be screwed to a wood block (mounted well clear of the hot-oven front) outside the oven door, together with the controlling switch. The metal tube should, of course, be earthed. Connection from ceiling roses immediately above the ovens should be made by means of asbestos-covered flexible inside a braided asbestos tube. The general warmth will maintain the insulating properties of the asbestos.

This arrangement has been in daily and most successful use by the employés of a large bakery in this town for the last three years.

The ovens, four in number, were previously lit with gas, which was found useless, as some moist heat in the form of live steam is applied, which extinguishes the gas.

The weakest point is the lamp cap contacts, but the average life of the lamps used exceeds two months. Probably manufacturers could overcome the difficulty.

I understand that each lamp spends about 80 minutes of every 24 hours in the ovens, which work at temperatures of 550°-575° F.

Blighter.

Wimbledon.

Fuse Formulæ.

Mr. Murdoch's reply to my letter of the 28th ult. contains no references to the points I raised. I therefore conclude that I have convinced him that he had not understood the paper he set out to criticise.

Of course, if Mr. Murdoch is only out for "amusement," we may ask in vain, but, perhaps, some of your readers would like to know which formula he finally recommends. In his first letter he upholds the index 1·5, and in his second puts forward 1·0.

The hypotheses upon which the latter is based are certainly more extravagant than the supposition that ρ_θ is constant (I presume ρ_0 in the second letter was a slip of the pen), especially as the author of the original paper supposes that the current "is increased very slowly until the wire fuses." Naturally this cannot be absolutely true, but the fact that the current density will be greatest where ρ_θ is least has an obvious tendency to eliminate the small temperature gradient over the cross-section. Owing to the high thermal conductivity of copper, a very slight temperature gradient will cause a very rapid thermal flow, and to suppose that there is an appreciable thermal gradient when the current is increased slowly is in opposition to everyday experience.

If Mr. Murdoch will bring forward serious arguments, and not merely make wild assertions, his remarks will be read with great interest by many "poor electricians," who, like myself, are not connected with South Kensington, and who might be persuaded to "bow down and worship" with Mr. Murdoch at the shrine of his new theory (as he himself proposes).

It would be interesting to know, by the way, why Mr. Murdoch's obvious antipathy to South Kensington should be dragged into this discussion.

F. T. Chapman.

Hendon, N.W., *November 11th*, 1912.

Switchgear Drawing-Office Expenses.

Your correspondent, "C. D. L.," cites three cases where trouble has arisen through inadequate or incorrect drawings. From the information given, it would appear that in cases 1 and 3, correct drawings were not obtained after the order was placed, whereas in case 2, detail drawings of special interlocking gear were requested and refused in the tender stage. I have never known a manufacturer to refuse copies of working drawings when an order is placed, because such drawings have to be made for the works, and there is no trouble in obtaining blue-prints for the purchaser.

With regard to case 2, I fail to see why a manufacturer should be expected to develop and show in detail special interlocking gear in the tender stage. Generally speaking, the cost of designing such apparatus is more than one-half its selling price, so that virtually the manufacturer is asked to complete half the work before receiving the order, and then it may be unproductive. Surely this is most unreasonable. If six manufacturers are set on the same task, it means that the total expense incurred is three times the value of the apparatus.

Again, "C. D. L." does not consider a tender sufficiently complete unless the manufacturer has set out every detail. Here, again, I think he is unreasonable. To effect this work the manufacturer may have to expend 5 per cent. of the value of the job on drawings and estimates. If now 10 firms are tendering, and each does the same amount of work, it means that 50 per cent. of the value of the order is expended in tendering only. It is admitted that drawings are required to form the basis for a tender. The important point, however, is that such drawings need be made by one party only, and not by every tenderer. Tender drawings are never accepted as final, and are always subject to modification; therefore, if one party makes a diagram of connections and a general layout of the board, it is sufficient for all tenderers to quote the same, and to signify whether they can get their switchboard in the space available.

The question of who is to make the drawings depends on the capability of the purchaser. If he knows what is the most up-to-date practice as regards layout of gear, protective devices, measuring instruments, &c., then it is most economical for him to make the drawings. If, however, he is not a switchgear expert, it is much better for him to invite a capable manufacturer to inspect the site, and, after seeing local conditions, to prepare a scheme with drawings. The job could then be put out to open tender, and in order that the purchaser might not feel under any obligation to his adviser, he might ask tenderers to include an amount to cover the cost of this preliminary work. One great advantage

of such procedure would be that all tenderers would be quoting for the same style of board and the same amount of gear, so that a fair comparison of prices could be made.

The engineer who wishes to make his own drawings will have no difficulty in getting dimensioned sketches of standard pieces of apparatus from manufacturers; in fact, these can often be taken from catalogues. What the manufacturer objects to is not the expense of sending blue prints off existing drawings, but the labour of making new drawings.

The purchaser might argue that there is an advantage in setting half-a-dozen manufacturers to work on his scheme, as he has then an opportunity of seeing which of their arrangements he likes best. This is all very well from his point of view, but it is not economical in the broadest aspect, and if it is persisted in manufacturers may find it necessary to charge for the advice given. Economy can be effected along two lines :—(1) By reducing the cost entailed by each tenderer; (2) by increasing the chance of each tenderer procuring the order, or, in other words, reducing the number of tenderers.

The amount a manufacturer has to add to his estimate to cover tendering expenses depends on the proportion of orders received to the jobs tendered for, and the amount expended on each. If he gets one job out of ten, and spends 2 per cent. on each job, it is obvious he should add 20 per cent. to each estimate. If now the expense is reduced to 1 per cent. the amount he has to include is reduced to 10 per cent., or, again, if he gets one job out of five instead of one out of ten, he can still expend 2 per cent. on each tender and have to add 10 per cent. only.

It is certain the purchaser has to pay in the long run for tendering expenses, and it is to his own advantage that he reduce the number of tenderers, also the amount necessary to be expended by each.

S. F.

Manchester.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Unica" Accumulator Sediment Pump.

The "Unica" pump is a continuous action suction and force pump of very simple construction, and specially adapted to the conditions under which it has to work. The illustration herewith shows the corrugated india-rubber suction hose, and a suction tube nozzle attached thereto, as well as the delivery hose. Stuffing boxes and packings subject to wear are entirely avoided. The materials employed in its manufacture are acidproof, thus saving repairs and other inconvenience under normal working conditions. The pump lifts the lead sediment and other foreign matter resting on the bottom of the cells, such as solid lead or pieces of glass, without the necessity of shutting down any part of the battery. The removed sediment is replaced by a corresponding amount of acid.

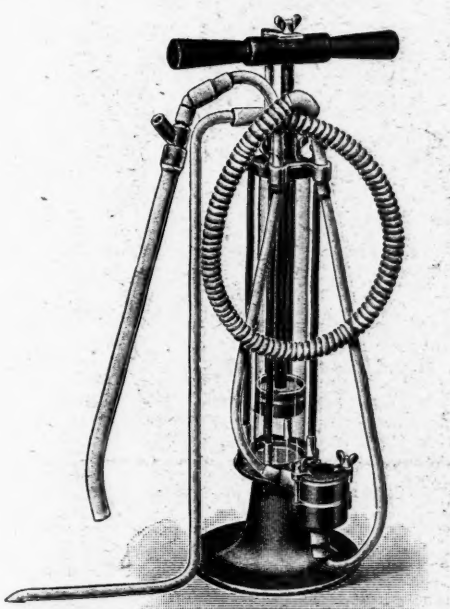


Fig. 1.—Unica Sediment Pump.

Besides the necessary suction and delivery hose, flat suction tubes with enlarged outlets and round suction tubes with rectangular bends and suction holes suiting the cell dimensions, are supplied with every pump. These allow of convenient insertion even into fully built-in cells and between narrow standing plates, the pump thus having a wide range of application under all possible conditions.

All holes which the sediment passes through have a large section so as to avoid stoppage; owing to their special design, the simple clack valves are not liable to cause stoppage. It is an essential feature of the pump that the suction sets in with full atmospheric pressure from the beginning, so that the heavy lead sediment, and even solid lead pieces, are at once lifted. From each of two large batteries, consisting of 60 and 120 cells, one ton of solid lead sediment was removed within 8 and 15 hours respectively; these figures do not, however, represent the maximum outputs attained. This apparatus is supplied by the Polystat Electric Co., of 222, Marsland Road, Sale, near Manchester.

New Prometheus Convector.

The British Prometheus Co., Ltd., of 9, Newman Street, London, W., have brought out the new pattern of convector which is illustrated herewith. They are this season extensively adding to their numerous designs, and have on view at their London showrooms over 50 designs of convectors and lamp radiators. The Prometheus convectors are guaranteed for a period of five years.

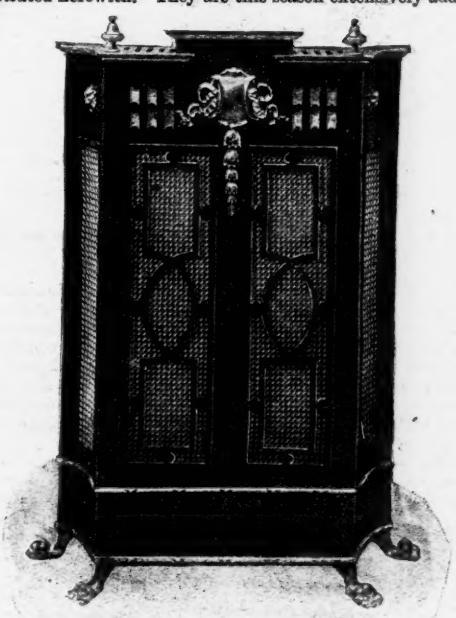


Fig. 2.—New Prometheus Convector.

The "Dionic" Water Tester.

The introduction of a conductivity tube, suitable for measuring the conductivity of seawater without dilution, and the development of a new form of tube adapted for use in pathological research, where the quantity of material obtainable for tests is very small, has caused increased interest in this instrument. It will be remembered that the principle of the "Dionic" method is to ascertain the condition of a solution by measuring its conductivity. Where the material to be tested is a weak solution of any salt in water, the sensitiveness and accuracy of the method are remarkable, so that the "Dionic" method is very useful for testing steam condensers, priming in boilers, &c. It has been shown also that tests of the conductivity of blood have great value in diagnosis, as the conductivity is found to vary in different kinds of disease, even when these diseases have similar symptoms in other respects.

A new abridged list of the instrument is in preparation, and will be sent to anyone interested on application to the makers, Messrs. Eversheds & Vignoles, Ltd., at Acton Lane Works, Chiswick.

"Scott" Electric Car Starter and Generator.

Messrs. Laurence, Scott & Co., Ltd., of Norwich, are showing at Messrs. Crossley's stand at the Olympia Motor Exhibition, an electric self-starter, combined with a generator for car lighting—a development which appears to find considerable favour with exhibitors this year.

Messrs. Laurence, Scott employ a small machine, designed to give a powerful torque as a series motor when run off a small battery and by means of a 20 to 1 chain drive to turn the engine crank-shaft for starting purposes; also as a generator (a shunt winding being provided which is not used when motoring) to satisfactorily charge the battery, the cells being then arranged in four parallels.

For motoring with, say, a 15-H.P. car, a pressure of 24 volts is used, the cells being in series; for lighting with the cells in parallel, 6 volts is obtained. The gearing of the starter is interesting; a pinion on the armature shaft *a* gears into three planet wheels *b* revolving on fixed pins in a disk wheel *d*, the planet wheel pinions gearing into a wheel *e*, the elongated boss of which carries the sprocket wheel for the chain drive to the engine shaft.

The gear system is a free one until the disk wheel *d* is held by means of the bandbrake *g* on its circumference, in which case the rotation of the armature shaft drives the sprocket-wheel and chain.

In order to prevent the engine, when it starts from driving the armature back through the gearing, a free-wheel clutch *h* is interposed, which allows the disk-wheel gearing and armature to rotate as one piece in the opposite direction at chain-wheel speed. The band brake is released when the engine has started, and the driver then puts his starting switch into position for charging, the charging switch—a separate one—being put in as required.

When charging, the armature is driven direct at chain-wheel speed through the little free-wheel clutch *k*, which is free when the armature motors. It will be noted that in this starter the strain of a back-fire would come on the disk wheel in the same direction as the starting strain, and that in this direction the band brake tends to release itself under excessive strain and the back-fire spends itself in the usual way.

The free running planetary gearing (except at starting) also renders unnecessary any automatic cut-out.

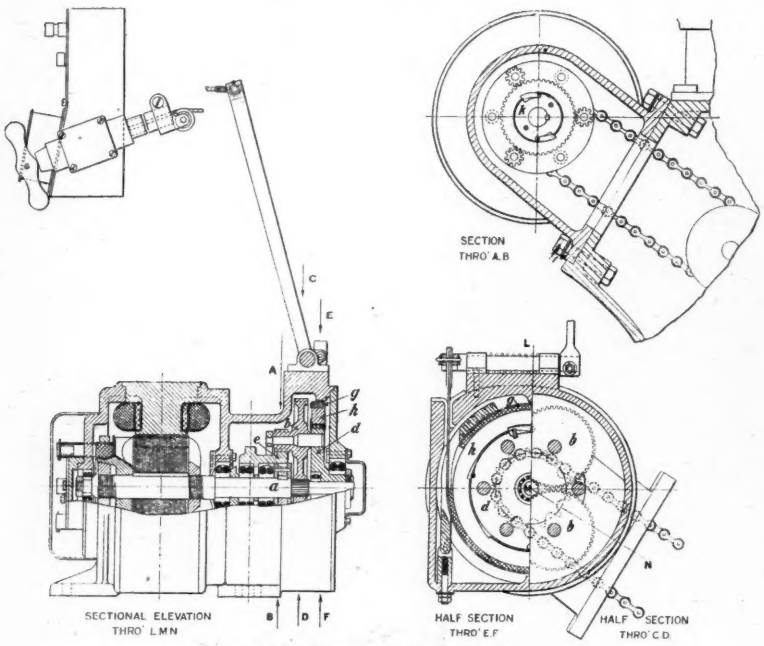


Fig. 3.—The "Scott" Motor-Car Starter.

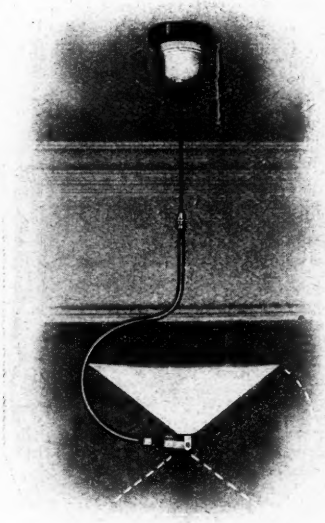


Fig. 4.—Instanta Adjustable Pendant.

B.T.-H. Veluria Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., have recently placed on the market a reflector under the name of "Veluria," in extensive and intensive patterns, of which the respective light distributions approximate closely to those given by the corresponding types of prismatic glass reflectors. Unlighted, Veluria glassware has the appearance of Italian marble; alight, it exhibits a warm, delicate alabaster glow, yielding a soft, mellow-toned illumination.

Instanta Adjustable Pendants.

Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., have just placed on the market the "Instanta Adjustable Pendants," one of which we illustrate in fig. 4. The device consists of a fitting for attaching to any ordinary electric-light pendant, by means of which the advantages of indirect or reflected lighting are instantaneously obtained at will. In one form it is unnecessary to disconnect or re-wire the pendant fitting, the attachment enabling the consumer to make the alteration himself in a few moments. The fitting includes a length of split brass tube, bent to an easy curve. At one end is a split cord grip of vulcanite, and at the other a fork carrying a swivelling carrier for the lampholder. The flexible wire is laid in the split tube, and the lampholder is secured to the carrier by its shade ring. The clip is then joined up and grips the flexible, enabling the attachment to be turned vertically or in any direction without twisting the cord. An alternative design consists of a closed tube, which necessitates re-wiring the lampholder. The latter design is somewhat cheaper. There is no attachment to the ceiling rose or ceiling, frosted lamps are not required, and there is a saving in the cost of installation and current consumption, as it is only necessary to install a single pendant in certain rooms where two or more ordinary pendants would be required, as the light can be instantaneously directed to any required position.

Electric Heating Carpets.

A carpet heated by electricity has been devised by Messrs. Otto Baur & Co., of Zurich, which, it is claimed, by heating the floor, affords the most effective and rational system of heating. The carpet is so contrived that it cannot be overheated, and it is perfectly flexible; the heating element is protected by a stout covering which is also waterproof. Any size of carpet can be made, from small pieces acting as foot-warmers to large ones covering the

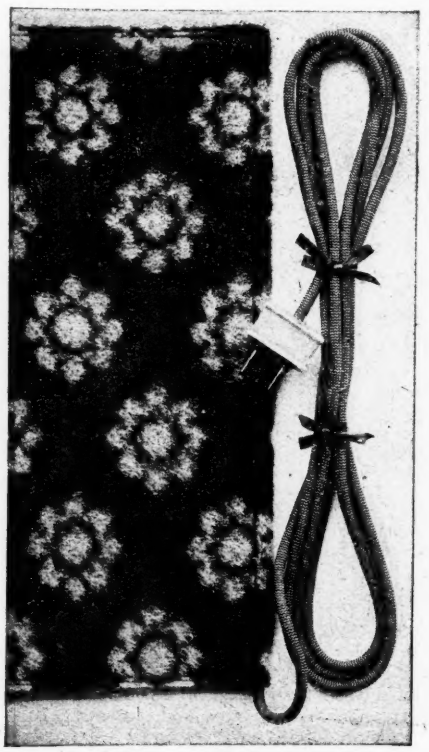


Fig. 5.—Electric Heating Carpet.

whole floor. The former are provided with flexible connections as shown in the accompanying illustration.

Bed warmers are also made on the same lines, as well as a variety of special medical appliances.

LEGAL.

The National Telephone Arbitration.

(*Continued from page* 771.)

Sir John Gavey, M.I.C.E., Past President of the I.E.E., a former engineer-in-chief at the Post Office, stated in evidence that he considered a figure of 8s. per pole for the cost of obtaining wayleaves as simply prepostrous. He quite recognised that the company might have more difficulty in obtaining wayleaves, because they had not the statutory powers which were possessed by the Postmaster-General. For Post-Office work he should consider that 1s. per pole was a high charge. He thought 2s. a pole might be allowed the company.

The Solicitor-General said that was the sum the Post Office had allowed.

Witness stated further that he was responsible for the expense incurred when the London telephone system was created. It was substantially an underground system, and the cost was necessarily higher than that in the outlying districts of London. The National Telephone Co. had not any corresponding work in the City of London, in fact he did not think they had any underground work in that city. The Post Office laid down 217 ducts before there was a single subscriber. They opened the first exchange in 1902, and to-day there were 20 per cent. of the ducts still quite empty, a further 20 per cent. only one-half filled, and 15 per cent. in which there was room for further cables. With regard to making a comparison of the cost of the stations belonging to the company and the Post Office, he mentioned that the length of the wires was greater in the case of the latter than in the former, especially in the provinces, because the Post Office had to serve the public, whether it was a profitable undertaking or not, and the company only served subscribers. If the National Telephone Co.'s system did not exist, he should have no hesitation in saying that it could be erected in 2½ to 3 years.

Cross-examined by Sir A. Cripps upon the report of the Postmaster-General concerning the life of the plant, counsel asked Witness if he was responsible for the figures supplied for that report.

Witness said that whoever drew up the report no doubt made use of his figures, but whether they were used judicially or not he could not say.

Sir A. Cripps: Do you suggest that the Postmaster-General took the figures from other sources?—No.

Then you, as engineer-in-chief at the time, are responsible for the figures in that report?—Well, if you put it that way, I will accept it.

Giving further evidence, Sir John Gavey said he thought that 40 years would be a very fair life to allow for cast-iron pipes. He gave 15 years' life for wrought-iron pipes.

Questioned with regard to the employment of cement blocks as the constructive portion of conduits, Witness said that years ago he had had to consider their quality, as compared with that of competing systems, and had rejected them. In regard to the cables, Witness said that, as a result of inventory, he had come to the conclusion that the National Telephone Co.'s cables had a life of only 20 years, because, when they had reached that age, they would have to be withdrawn and replaced by others. He endorsed practically all that had been said by previous witnesses concerning the life of exchange equipment, subscribers' apparatus, &c., as affected more particularly by the obsolescence brought about by improvement in the methods of using the service. Dealing with the respective values of wood and iron in relation to telegraph poles, Witness said that a well creosoted pole would last 28½ years, whilst an iron pole would only last 15 years. As to wire, the physical life of 100 lb. copper wire stretched from London to John o' Groats might be 25 years, because, although its life might be affected by storms at certain parts of its extent, it could not affect the whole.

Sir John Simon: What do you say the physical life of a wire would be if, say, it were stretched over London?

Witness said that in that case the physical life would not exceed 15 years, because there the influences affecting the life of the wire would be concentrated on a smaller area.

Sir John next asked witness questions with regard to the common-battery exchanges.

Sir John Gavey said he estimated the life of a common-battery exchange at 15 years, and in doing so he had regard to the progress that was continually being made in the mechanical attachments of electrical science. The effective life of a magneto exchange he did not put at anything beyond 10 years. Personally, he was opposed to the use of the magneto instruments which the Post Office had taken over from the National Telephone Co. His experience taught him that the maintenance of plant increased from day to day with its age.

In answer to Sir A. Cripps, Witness said that the National Telephone Co. used 40 lb. phospor-bronze wire for its overhead bare wires, and the Post Office used 100 lb. copper wire. He estimated the latter's life at 25 years, and the life of the National Telephone Co.'s wire at 15 years. It was true that the equation value in the two cases might be the same.

Further cross-examined as to the advice given by him before the National Telephone undertaking was taken over, and the reports made by him to the Post Office when he was engineer-in-chief, and which seemed to conflict with his present support of the position taken by the Post Office against the company, Witness said he changed his opinion after he had visited America in company with another official of the Post Office, for the purpose of examining the telephone system there.

At the conclusion of Sir J. Gavey's evidence, the Solicitor-General recalled Mr. Snell, the Post Office expert. This witness, in conjunction with Mr. Gill, the engineer-in-chief for the National Telephone Co., was engaged in considering the question of subscribers' apparatus and other questions, which Sir John Simon said were not embraced in the main question to which he desired to address himself. If these two gentlemen did not arrive at an absolute agreement on these subjects, they would at least agree on alternative multipliers, either of which the Court might use to arrive at the life value of the plant affected. Proceeding to submit arguments to the Court on the main question, the Solicitor-General said that the parties had happily started with one or two matters fundamentally agreed, and these included figures which represented the fundamental cost of labour, material and freight. From that point of view there were two further stages to be traversed on the route to a decision in the case. They had, first of all, to ascertain how much it would cost beyond the amount of the fundamental agreement to replace anew the whole of the National Telephone Co.'s system. Having ascertained that cost, it then became necessary to learn by how much the plant had depreciated at the time it was taken over by the Post Office. The deduction of the amount of depreciation had then to be made from the cost of the replacement.

Mr. Danckwerts, K.C., interposing, said it must not be understood that he assented to this argument of the Solicitor-General.

Mr. Justice Lawrence: We could hardly hope for that.

Continuing, Sir J. Simon said that they had to bear in mind what it was the Court was aiming at, and the method to be adopted in order to arrive at it. The object was the lump sum award to be paid to the company by the Post Office, and the method was first to find the cost of replacement of plant, and then to determine the amount of depreciation upon it.

His Lordship remarked that the reason that method had to be applied, was because there was no market gauge of value. The plant was useless except to one or the other of the parties. It would be unreasonable if the Post Office refused to take over the plant, because there was no other buyer, and if the company refused to sell that would be equally unreasonable. The sum, therefore, which one party had to pay to the other must be determined by the cost of construction. There was no other buyer than the Post Office.

The Solicitor-General said he agreed, but with one qualification, and an important one, viz., that it would not be right, in his opinion, to put the value of the undertaking at the cost of it to the company.

His Lordship said he did not mean to suggest that. What he meant was to put the value of the undertaking at the cost to the person taking it over to replace it.

Sir John Simon, continuing, said he thought he could show that it was no longer of importance to consider whether the construction of the replacement work should occupy two, three or five years, because the fundamental cost of labour and materials having been agreed upon, there would be no sensible difference in the cost of supervision and in the other points now in dispute, even if the period of construction were protracted to a longer period, provided that were not beyond such an economic period as might be assumed to be necessary for the construction of the system without spreading out the cost of labour and materials, so as to entail a disproportionate cost of supervision. The company assumed for their economic period of construction 12 years, and gave the figures of cost on that basis. The Court, however, must observe that that was the cost to them and not the cost that would be involved in reconstructing the system in another and a different economic period under different arrangements. Their method of construction was piecemeal, and necessarily more expensive than if carried out as a whole, and they applied the figures of cost under this method to their hypothetical economic period, which, in his opinion, was a most fallacious way of dealing with two unlike processes. In estimating the period that a hypothetical contractor would take to recreate the system, there had to be borne in mind that he would start with a definite scheme in his mind, and could lay out his whole design for the purchase of the material, the employment of labour and supervision in the most economical manner. Proceeding to set before the Commission the difference between the charges beyond fundamental cost estimated on the one side by the Post Office, and by the National Telephone Co. on the other, learned counsel reviewed a great mass of the evidence given, with a view of showing that, beyond the 10 millions odd agreed upon for the cost of labour and material, the estimates made upon the basis of 20 per cent. for contractors' supervision, &c., 10 per cent. for contractors' profits, and 5 per cent. for what was called "employers' burden," were an ample provision for extra expenses, and that the company's extra charges for local storage, interest upon money during construction and for what were called "headquarters administration charges," were unreasonable. The company's claim for supervision had been made out without introducing the question of sub-contractors specifically, but including it in effect, and he (counsel) in arriving at the claim for supervision which the Court would have to consider, struck out all that might be ascribed to that account, making a difference of nearly £300,000 between the amount estimated by the Post Office and that estimated by the National Telephone Co. It had been argued by counsel for the company that if

that deduction were made, the percentage of supervision to the plant cost would have to be arrived at in a different way. Under the circumstances that would be perfectly fair. In respect of local engineering supervision the company wanted to add about £2,000,000 to the fundamental cost of £10,000,000 agreed upon; for ordering and storing the company charged £471,614, which it could not be suggested were too small. Local administration, supervision, and local engineering supervision between them in the company's claim represented over £2,000,000, and wayleaves £169,368, which together made a total of £2,647,234, the whole of which hinged on an estimate of £592,000, the average plant cost during a composite year extracted by the company from an equation of the cost during 12 selected years assumed by them as an economic period. He contended that that figure was quite abnormal. In 1905 the company knew that it was condemned to death within a limited time; it knew that its corporate existence would come to an end on December 31st, 1911. For six years it was in the condemned cell and knew the way in which at the close of the stipulated period its executioners would dispose of its property; yet from 1905 to the end of its life it never kept any record of its affairs. It had constructed millions of pounds' worth of plant during that period, knowing all the time the terms upon which that plant would be taken over, but hoping to add to its value in the way which had been disclosed to the Court. At the close of the company's life the expenditure on construction naturally became smaller, and it was one of these abnormally small years which had been chosen to estimate the percentage of supervision to construction, the cost of supervision then being practically the same as during the years when construction was proceeding rapidly.

Continuing, the Solicitor-General dealt with the question of head office expenses, and submitted that the total charged by the National Telephone Co. under that head was too much because it had been arrived at upon a wrong basis. The Post Office figures generally, he said, were arrived at not only with the help of experience, but with the help of additional checks at their command. This fact made it more likely that their figures were reasonable and fair.

Sir Alfred Cripps, intervening, said he disputed the accuracy of the Post Office figures in the matter of materials and labour cost, &c., because they were arrived at on the assumption that 2½ years was a sufficiently long time in which to do the work.

Sir J. Simon occupied many hours in reading the evidence which had been given during the course of the case.

(To be continued.)

Edmundson's Electricity Corporation, Ltd.

Mr. Justice Neville, in the Companies' Court on Tuesday last, heard a petition by the above company for sanction to a reduction of its capital, as proposed in resolutions adopted by the shareholders and already reported in the Electrical Review.

Mr. Younger, K.C., appeared in support of the petition.

There was no opposition, and his Lordship sanctioned the reduction as proposed, directing the order to be advertised in the same papers as the petition, and the use of the words "and reduced" by the company for one month.

The National Telephone Co.

In the Companies' Court on Tuesday, an application was made to Mr. Justice Neville with reference to a summons taken out in the liquidation of the National Telephone Co. to determine questions that had arisen as to the distribution of the assets.

Mr. Percy Wheeler, who represented the liquidator, said that the company went into voluntary liquidation in January last, and the summons had been taken out to determine the rights of the ordinary shareholders and the various classes of preference shareholders. The summons was directed to be heard by his Lordship that day fortnight, but it was difficult to ask him to determine the matter, as when a member of the Bar he had advised on a number of questions concerning the company. It was therefore thought that his Lordship would prefer the summons being heard by Mr. Justice Swinfen Eady. The summons raised questions of some difficulty as to the construction of the memorandum of association, and there were many hundreds of shareholders interested.

His Lordship said he would communicate with Mr. Justice Swinfen Eady, who would no doubt fix a day for hearing the summons.

Gery *v.* Day Motor Co.

In the High Courts, on Tuesday, November 12th, the Official Referee, Mr. Muir Mackenzie, had before him an action by Mr. Alfred Robert Orton Gery, 7, Ormonde Terrace, London, N.W., against the Day Motor Co., Ltd., Riverside, Putney, claiming the sum of £52, money which plaintiff had paid the defendants in respect of the installation of an electrical generating apparatus at plaintiff's country house, Royston Court, Ferryside, Carmarthen. Plaintiff alleged that by a contract in writing made between defendants and his (plaintiff's agent), Mr. R. F. Browne, defendant company agreed to supply, in 1911, an electrical generating apparatus for use in Royston Court according to certain specifications and conditions, viz., that it should work direct, and that it should be efficiently governed automatically so as to permit of a momentary speed fluctuation of not more than 6 per cent. on a sudden alteration of the load to the extent of 25 per cent. between 50 per cent. and full load on the engine. On November 13th, 1911, defendants delivered the apparatus, which purported to comply with these conditions. Plaintiff paid £52 as part payment on delivery. Subsequently, he found that the plant did not comply with the conditions laid down, with the result that the apparatus was useless. By reason of breach of contract, plaintiff alleged that he had suffered loss, and he claimed damages in respect of such breach. Defendants denied liability, and counterclaimed for £21 11s. 6d., being the balance due on the price of the plant, also certain expenses.

Mr. Barrington Ward appeared for the plaintiff, and Mr. Colefax, K.C., and Mr. Walker were for the defence.

Mr. Ward opened the case, detailing the facts as given above. He stated that the plaintiff required the plant for the purpose of lighting his house with electricity. He consulted Mr. Browne, who was an electrical engineer, and subsequently the contract was placed with the defendant company. In conclusion, counsel submitted that the engine was sold for the purpose of supplying electric light, and if he could prove it failed to do this he then had a right to reject the plant. Counsel then read the evidence of Mr. Browne, which was taken on commission, the witness, who described himself as an electrical engineer of 16 years' experience, having been called to South Africa. He said he acted throughout the matter as plaintiff's agents.

The Plaintiff gave evidence, and said he gave the work to the defendants because their catalogue seemed to contain what he wanted; a very simple engine which could be managed by any unskilled artisan. The delivery of the plant was very late, and it was not complete. There was no representative of defendants present when it came, and the engine, &c., was eventually assembled by the firm who were wiring his house, Messrs. Brooking and Co. The engine driven by petroleum ran very badly, and as all the lamps in his house had been converted into electric lamps, the occupants of his house had to do the best they could with oil lamps and candles. The engine never was fit to supply his house with electricity. Eventually he was advised that the engine was not fit to do the work required of it, and after affording defendants every reasonable opportunity of putting the matter right, he finally rejected the engine altogether.

Cross-examined, Witness said he spent hours trying to make the plant run.

(To be continued.)

Long-Firm Frauds.

Before Judge Lumley Smith, at the Central Criminal Court on Tuesday, James Winslow, 39, merchant, Frederick Carrier, 37, accountant, and Frank Horace Hepden, 31, merchant, surrendered to their bail and pleaded guilty to an indictment charging them with conspiring together and obtaining quantities of goods by means of false pretences. Amongst the goods which the defendants were charged with obtaining were steel balls from the Hoffmann Manufacturing Co., electric lamps from Ward & Goldstone, and various goods from firms not connected with the electrical industry.

Mr. A. H. Bodkin and Mr. Percival Clarke prosecuted for the Director of Public Prosecutions, whilst the defendants were represented by Mr. Curtis Bennett, Mr. Eustace Fulton and Mr. Purcell respectively.

Mr. Bodkin said that the defendants had conspired to obtain goods by false pretences from persons who were induced to deal with a firm known as Darton & Co. The defendant Winslow was adjudicated a bankrupt in 1897 at Swindon, and Hepden, who was also known as Hampton, was adjudicated a bankrupt in January, 1910. Neither of them had ever obtained their discharge under those proceedings. The firm of Darton & Co., was established in the early part of the present year at 3, City Road, E.C. They described themselves as importers and general shippers and manufacturers' agents, and apparently the trading style of Darton & Co. was adopted, as a respectable and old-established firm of that name was in existence in the neighbourhood. The three defendants were associated in the firm of Darton & Co., and there were others in complicity with them. A large quantity of miscellaneous goods was obtained, but proper books were not kept, and there was nothing to show what became of the goods. At the same time as Darton & Co. was founded, a concern called "Hampton" was established at 54, Lower Thames Street, E.C., which was really Hepden. That business was created for the sole purpose of giving references to Darton & Co. Another business for the same purpose was established under the style of the Union Trading Co., at Finsbury Avenue, E.C., with which were associated men named Bird and Trueman, the latter also being known at Cattell. The Union Trading Co. occupied a room at 10s. a week, and left owing £5 10s. for rent. When the bailiffs went in all they found was an empty inkpot, a chair with the bottom knocked out, and a table consisting of some planks and a couple of boxes. Last March Darton & Co. wrote to the Hoffmann Manufacturing Co. for terms, and subsequently gave an order for 900 gross of steel balls. The Hoffmann Manufacturing Co. asked for references, and Darton & Co. gave the names of Anderson & Co., of 12, Aldgate, E., and Hampton, of Lower Thames Street. Anderson & Co. was another firm which was constructed solely for the purpose of giving references to Darton and Co. The reply of Anderson & Co. to the Hoffmann Manufacturing Co., was that the former had known Darton and Co., had done considerable business with them, received prompt payment, and regarded them as good for credit. That letter was signed "J. A.," but it was in the handwriting of Winslow. The other reference was given by Hepden, under the name of Frank Hampton, and he wrote, "The

account is kept to my entire satisfaction." The premises occupied by Anderson & Co., were taken by Carrier, who was accompanied by Winslow, and the reference they gave to the landlord was Darton & Co. The address of Anderson & Co. was simply one for letters. On the references given, the Hoffmann Manufacturing Co. thought the matter was satisfactory, and supplied the goods, but never got paid for them. Darton & Co. gave an order for a piano to Musicus, Ltd. The references supplied were Anderson & Co. and Ray & Co. The reference from the latter firm was written by Carrier, and the premises occupied by Ray & Co. were held at a rental of £1 a month. As the references were satisfactory, Musicus, Ltd., supplied a piano, and were then applied to for three more instruments, which they declined to deliver. Mr. Bodkin said it was interesting to note that Carrier had obtained an Empire typewriter which was never paid for. The letters from Anderson & Co., Ray & Co., and some from Darton & Co., were written on that particular typewriter. An order was received from Hepden by Musicus, Ltd., for a piano, his reference being the Union Trading Co., from whom an excellent testimonial was received. He was supplied with the piano, which was not paid for. Proceedings were taken by Musicus, Ltd., against Darton & Co., an execution was levied, and Carrier then came forward with a bill of sale, which had been executed over the assets in favour of a man named Stephens. The latter was a man who had also given false references to the defendants. The bill of sale was created for the sole purpose of fraud, for when he was arrested Carrier admitted that it was not a genuine charge, and that it was arranged by him. In face of the bill of sale, Musicus, Ltd., had to withdraw their execution. The cases mentioned were not isolated ones, but were selected as typical of the methods employed.

The JUDGE: Were any goods paid for?

MR. BODKIN: There are cases in which small trial orders were paid for, and afterwards large orders which were not paid for.

Counsel added that when the premises of Darton & Co. were searched, certain books with some leaves cut out were found. These books contained entries showing that Darton & Co. had done business with the other firms mentioned as reference houses. As a matter of fact, there were no such transactions at all. One of the serious features of the case was the concocting of the bill of sale which was used to defeat creditors who had obtained judgment against the firm and desired to levy execution.

The JUDGE: There is a good deal of that goes on nowadays, but particularly where a man gives a bill of sale to his wife. It is quite common.

Police evidence was called to prove that Winslow had carried on business in Swindon, but was made a bankrupt and then traded in his wife's name. When the defendants were arrested, Winslow had started trading with another man at Great Portland Street, under the style of J. Lockwood & Co. Hepden had been adjudicated a bankrupt, with liabilities of £3,859, and no assets. Before going to 54, Lower Thames Street, he was in business at 61, Chiswell Street, E.C.

MR. EUSTACE FULTON said the cause of the trouble was that the defendants started the business with an inadequate capital. It was not the ordinary case of a long firm fraud, in which the partners disappeared after a few months' trading. They started a genuine business, but owing to lack of capital could not carry it on.

MR. CURTIS BENNETT and MR. PURCELL also emphasised the remarks of Mr. Fulton, and pointed out that all the defendants held good characters.

The JUDGE said that the defendants had committed a serious offence. In the City business was very largely done on credit, and considerable attention was paid to the giving of references. Wholesale houses who took up references had a right to assume that the replies given to inquiries they made were correct. In the present case it had been shown that the references given to wholesale houses had been written in the office of Darton & Co. The least he could do was to impose a sentence of 10 months' imprisonment in the second division on each of the defendants.

GOTT *v.* VERITYS, LTD.

AN action in which Arthur Edgar Gott, A.M.I.E.E., electrical engineer, of Lanercost, Villiers Road, Southall, Middlesex, claimed damages for breach of contract from Veritys, Ltd., Birmingham, was heard by Mr. Pollock, K.C., sitting in the capacity of Official Referee, at the Victoria Courts, Birmingham, on Tuesday. Mr. R. M. Montgomery, on the instructions of Messrs. Sharpe, Pritchard & Co., London, appeared for the plaintiff, and Mr. Vachell, K.C., and Mr. Baber, instructed by Messrs. Ansell & Ashford, Birmingham, was for the defendants.

MR. MONTGOMERY explained that one part of the contract was for personal services, and the other part for the payment of royalties on certain patents of which Mr. Gott was the inventor. Counsel read the contract, which he said was contained partly in an agreement in writing of April 9th, 1907, between the plaintiff and the defendants, in which it was agreed that the defendants should manufacture and sell certain patented articles, and pay to the plaintiff the royalties. It was a further term of the contract that in the event of Messrs. Veritys desiring to discontinue the manufacture and sale of the articles, they should give to the plaintiff three months' notice to that effect. He (counsel) hoped to prove that the defendants, although they gave the plaintiff no notice whatever that they did not propose to continue to manufacture and sell, declined to allow their people to estimate for his patented articles On the contrary, they did not give the notice which they were bound to give, and starved these patents instead of allowing them to remain as "live" patents on the market, at the same time preventing Mr. Gott from making any use of them. Motor starters and controllers were the two important patents. In the middle of October, 1908, when there was little more than three months to run of Mr. Gott's employment, he was dismissed. No cause was given, and he was paid salary up to January 31st, 1909.

JAMES YOUNG, electrical engineer, Erdington, stated that on October 17th, 1908, he was employed by Veritys, Ltd., and was in charge of the designing in their controller department. He remembered plaintiff, who up to that time had also been in the service of the company, leaving. Shortly after he was asked to get out a line of starters, which he distinctly understood were to replace the existing ones of Mr. Gott, which he was told were too dear, and did not sell well. He knew Mr. Gott's starters well, and knew the patents, and so he had no difficulty in knowing what he ought to avoid in regard to them. He quickly got out new designs, and Mr. Gott's stock gradually ceased to exist, the new articles superseding it. During the three months before the new goods were ready the firm used up Mr. Gott's in many cases, and put new windings to some. Large stocks of material for the making of plaintiff's articles were put on one side and scrapped. There was a continuous demand for starters, and it increased after Mr. Gott had left. When witness began to design the starters he proposed certain methods, and he was told that the firm did not wish to pay royalties if they could avoid it. Asked if there was any saving of cost with regard to the starters except the saving of the royalties, witness replied that the starters were made more cheaply altogether. They were not made so well. If they had wanted to make Mr. Gott's starters in a cheaper way they could have done so. He thought new designs were also got out for switches, but he did not get them out. New designs were immediately produced of a drum controller, witness making the design. After the new design had been got out, so far as he knew, plaintiff's design was not used again for tendering for contracts, or in fulfilling contracts. The firm tendered afterwards on witness's design. Many controllers were bought by the Admiralty after Mr. Gott left, probably hundreds.

Cross-examined, witness said his instructions were to make a much cheaper starter to enable the firm to compete with other people.

The plaintiff, giving evidence, said that if the defendents in the case of the starters had reduced the efficiency of his make to the efficiency of the substituted make, they could have made his as cheaply, substantially speaking, as the substitute.

The REFEREE: There would still be the royalty.

MR. MONTGOMERY: Apart from the question of royalty.

Witness further stated that assuming that the firm ceased at the end of 1908 to manufacture his articles, the royalties which he received after that was on the residual stock, which was necessary to carry on business. He claimed that by starving the patents out and withholding them from the market in the way they had, the firm destroyed the value of the patents themselves. He put approximately three years' value on to each.

What was the yearly value of these patents—the starters and the controllers—what could you have got for them if you had had them in a "live" condition?—If I had had them to sell at the time I left, I could have got an amount equal to three times their yearly value.

What would have been their yearly value?—About £45.

In further examination, Plaintiff said that up to the time he left, the amount of royalties had been rising, with the exception of the last year, which was a bad year for trade, when he thought there was a slight drop. The amounts were £80, £61, and then they went up to £117 to the end of January, 1909. The action of the firm also had an effect upon his earning capacity. When he went to Messrs. Veritys he took all his starter experience with him, and when he left, he left it all behind and had to start absolutely afresh.

So that if they were not going to manufacture, it would have put you into a very much better position if they had told you so, and you could have used the patents?—Most decidedly so.

Cross-examined, plaintiff admitted that competition in goods similar to those covered by his patents was very keen.

MR. VACHELL: If the firm found that some of these articles so skilfully designed by you could not be produced at their works at a price which would enable them to compete with others, were they not quite right in having articles designed cheaper to enable them to do so?

PLAINTIFF: My complaint regarding the firm always was that the difference between the prime cost and the selling price was greater with them than other firms.

Other evidence having been heard, plaintiff's case was concluded. The Court then rose, the hearing being adjourned until the following morning.

(To be continued.)

Sentence.—Sentence of three years' penal servitude was passed by Lord Coleridge, at the Liverpool Assizes, on Monday, November 11th,, upon Arthur Evans Kennedy, electrician, formerly employed in the Liverpool electricity department, who was found guilty of sending a letter demanding money by menaces from Sir Chas. Petrie, chairman of the Corporation Tramways and Electricity Committee. Kennedy was dismissed from the Corporation's service in 1909, after a previous reprimand in 1907, given to him in respect of his work and conduct, and he imagined he had a grievance against Sir Chas. Petrie, Mr. Clough (electrical engineer), and other persons with whom he was associated at the works.

REVIEWS.

The Story of Wireless Telegraphy. By A. T. Story. London: Hodder & Stoughton. Price 1s.

This volume can be confidently recommended to the general reader and student requiring an easily intelligible review of the development of wireless telegraph theory and practice, up to the date of the first trans-Atlantic wireless message in 1903. For the benefit of readers who are not familiar with the first edition, we may mention that the progress of wireless telegraph theory and practice, from the middle of the nineteenth century to the first years of the present century, was there traced with a completeness which was extraordinary considering the small space occupied (183 pp.). Early experiments were practically confined to conduction methods, and aimed at securing wireless communication across rivers and straits, &c. (incidentally, it may be news to some readers to learn that water-conduction wireless telegraphy is still employed more or less regularly in communicating across various Indian rivers). The gradual improvement in submarine cable construction caused a temporary lull in the endeavours to realise wireless telegraphy, the chief application of which then appeared to be in maintaining communication with lighthouses and ships, &c. The conduction methods gradually gave way to induction methods, and finally the practical application and possibilities of Hertzian waves were realised. All these steps are clearly and cogently detailed by the author, who, very properly, lays frequent emphasis on the number of investigators who have contributed their quota to wireless telegraphy as now practised, and the number of men, chief among whom are Dolbear, Hertz and Lodge, who came within an ace of that practical triumph which was reserved for Marconi. There can be few fields in which so many brilliant investigators have been required to attain the goal aimed for, and in which the important significance of their work has been so frequently overlooked by the men themselves.

The enormous development in wireless telegraphy during the past decade has made the author's task in producing a revised edition most difficult. To bring the volume up to date, while adhering to the thoroughness of treatment adopted in the first edition, would involve at least twice as many pages, and hence a proportionate increase in the cost of the treatise. The production of a second volume, practically equal in size to the first, would doubtless have been very widely appreciated, but there are obvious difficulties and risks in extending a work of this class to two volumes and, while adhering to one volume, the author has probably pursued the best course in retaining the matter of the first edition *in toto* and adding 36 pages, reviewing broadly the technical developments and practical applications of wireless telegraphy since the epoch-making experiments of 1903.

In the original section of the work, a large proportion of the total space was naturally devoted to a description of the early attempts to realise wireless communication by earth conduction and by simple induction. This was as it should be in 1903, but now the rapid progress realised during the past 10 years should receive considerably more attention than is actually given, space being found if necessary by condensation of the earlier chapters. As a review of progress up to 1903, the work is exceptionally valuable, but the new section is much less complete and detailed. As already explained, there is considerable excuse for this fact, but a number of misprints in the original should certainly have been corrected in the new edition, and many of the original half-tone blocks are now so worn as to be practically worthless. There are several instances in which the statements in the earlier edition should be somewhat modified in view of recent developments, and one important omission is that no mention is made, in the chapter on telegraphic communication with trains, of the wireless system now in use on the Great Western Railway.

The supplementary section in the new edition recapitulates the historic instances in which wireless telegraphy has already proved so valuable in saving life at sea, and deals with the proposals for an all-British world radio-network. This review is thoroughly up-to-date, the *Titanic* disaster, the Marconi agreement and the use of wireless in Tripoli being all noted. A number of interesting photographs of notable marine and land stations are included, in addition to two excellent maps showing the sites proposed for the Imperial wireless stations and the stations at present in commercial operation.

It would have been well to have devoted a little more space to a statement of the numbers of land and ship stations at present in operation, and some mention should certainly have been included of the important applications of wireless telegraphy to storm warning and navigation in general (the latter application is briefly noted), of the wireless time services now established, and of the special wireless sets which have been devised for use by small fishing vessels, for the reception of time signals by private stations, and for use in cartography.

The author devotes a paragraph to emphasising the responsibility of the work of every wireless operator, and we here endorse his tribute to the merit and importance of the "small-wage-man," and add what encouragement we may to the latter to persist in his conscientious performance of duty, and endeavour to improve the details of construction and manipulation of the apparatus under his care.

Wireless Telegraphy and how to Make the Apparatus. London: Cassell & Co. Price 1s. net.

This work can be thoroughly recommended to amateurs and students interested in the erection and working of experimental wireless apparatus. Various chapters are written by different writers, each specially qualified to deal with his own section. The matter is well arranged, and is easy to follow, the earlier parts dealing with the construction of all the fundamental parts of the transmitting and receiving apparatus, and a final section dealing with more special apparatus, or what may be termed the refinements of apparatus and operation.

A popular introduction to the subject is given, in which, however, we should like to see space devoted to a consideration of the nature, effect and interrelation of damping, tuning, frequency and so forth; a short theoretical section along these lines would greatly facilitate intelligent study of the later sections.

The instructions given for the manufacture and erection of the various pieces of apparatus are definite and well illustrated. The best apparatus from the amateur's point of view is always treated in detail, and materials are recommended which are easily worked and cheaply procurable (so far as is consistent with efficient working); more complex or otherwise less desirable constructions and methods are briefly mentioned when of sufficient importance. The dimensions recommended seem to be those covering the average needs of an amateur, but we would suggest that some space might well be devoted to a simple explanation of the methods of design of inductance coils, condensers, &c., so that readers could become more familiar with the subject and vary the proportions of the apparatus with some degree of certainty so as to suit any special conditions. Once embarked upon theoretical matters, however, it is easy to go beyond the limits desirable in a work of this class.

The construction suggested for a carborundum detector (page 18) is rather crude, and is not likely to give satisfactory results. The reviewer has found the best means of constructing electrolytic detectors to be to melt the drawn-out end of a small glass tube completely on to a fine platinum wire previously inserted in the bore of the tube. The latter is then ground on a fine oilstone till a sharp section of the platinum wire is exposed; to save cost, a short length of platinum should be hard soldered to a bare copper lead supported by a small cork in the top of the tube. We do not notice any remarks as to the importance of an earthing gap or plug providing a direct discharge path to earth during storms, or when atmospheric electrical disturbances are specially violent. On observing more or less violent sparking across the earth gap, the latter should be plugged and experimental work stopped for the time being.

Considerable space is devoted to a description of the construction of an induction coil, and of the "Vril" trembling contact maker and a good type of mercury make-and-break. The instructions for the erection of the rest of the apparatus

required are equally excellent, but readers would doubtless appreciate approximate estimates as to the cost of materials for the various parts of the equipments.

The value of systematic measurements of the currents in the various circuits and some form of record of the results obtained should be emphasised. The amateur experimenting with quite simple apparatus, having plenty of leisure, and exercising considerable patience, can quite well discover improved connections and types of detectors (to cite only two lines of research). Systematic procedure and infinite patience are very essential. There are so many variables in wireless transmitting and receiving circuits that considerable trial is required (particularly by an inexperienced operator working with a new equipment), to obtain satisfactory results. Residents near London, or near the large stations which now exist in considerable numbers round our coasts, will find the powerful signals emitted by these stations very useful in adjusting their own circuits to maximum sensitivity. Where such stations are not near by, work must be commenced over quite short distances (even from one end of a room to another), before sufficiently fine adjustment can be secured to allow of operation to the full range of the experimental station, and the detection of signals from remote powerful equipments.

Electric Traction and Transmission Engineering. By S. Sheldon and E. Hausmann. 1912. London: Crosby Lockwood & Son. Price 12s. net.

This book attempts to give a perspective view of the design of a complete railway installation, from the cars to the power station, to indicate the nature and sequence of the various problems entailed, and to consider appropriate methods for their solution. This somewhat ambitious task has been undertaken because, in the author's opinion, no single published text-book meets the multiplicity of facts and details to be considered in determining the final elements of a complete electric traction scheme. However true this may be in the United States, it certainly does not apply in this country.

Chapter I deals with the determination of the number and size of cars for an urban road. Some interesting results are established, but the data given refer entirely to American practice, sums of money are expressed in dollars, and so on.

Tractive effort required for car propulsion is discussed in Chapter II. By making some reasonable assumptions the author obtains a formula for train resistance which is quite interesting from the point of view of a student. This chapter also contains a quantity of elementary mechanics on accelerations, inclines, &c., which might quite properly have been supposed to be in the possession of a student at this stage of his work.

A good theoretical description of types of motors, both direct and alternating current, and their performance curves is given in the next chapter. Methods of driving, however, receive very scanty attention.

In Chapter IV adequate consideration is devoted to the important subject of speed curves, and the point to point method of pre-determining performances is well described; but we are sorry to see the vital problem of choice of gear ratio dismissed in seven lines. A somewhat remarkable fact, if it is correct, is given in a table in this chapter. A 50-H.P. interpole motor by two different makers weighs more than a 60-H.P., the difference in one case being 235 lb., and in the other 25 lb.

Chapter V is one of the best in the book, and deals with the various types of controlling apparatus required for alternating and direct-current traction. The advantages and limitations of the different available systems are well and clearly described.

Energy consumption, root-mean-square currents and similar problems are next discussed, and a small amount of information is given as to the effect of different gear ratios on energy consumption and temperature rise.

The distributing system, classification of conductors, electrolytic surveys and kindred matters next receive attention. The matter, so far as it goes, is quite good. In this chapter, and, in fact, throughout the book, the rather weird unit known as the circular-mil-foot is used.

The design of sub-stations and the costs relating thereto are treated of in Chapter VIII. The part dealing with the design and arrangement of sub-station apparatus is decidedly good, but the sections dealing with costs give figures which are altogether higher than those obtaining in this country, and as far as English practice goes are rather misleading to a student.

Chapter IX deals with the large and complex subject of overhead transmission lines, and seeing that only 58 pages are occupied, a considerable amount of good and reliable information is given. In connection with this chapter, as with others in the book, a competent knowledge of determinants, hyperbolic functions and differential equations is a necessity.

The final chapter discusses the arrangement and costs of steam and hydraulic power stations. The usual types of apparatus are described, and the chapter is in no way remarkable.

On the whole, the book may be described as a fairly good one for the price. Since the book has been professedly written for students, it is well that specific forms of apparatus have been omitted as far as this is possible, an attempt having been made to concentrate attention on principles. In many colleges, far too much time is spent on particular forms of apparatus, and altogether too little on fundamental ideas, and we are glad to see that this book is free from this defect.

The literary and logical style of the book are deserving of the highest praise. The printing and binding of the volume are excellent.—H.G.S.

MONOPOLIES IN GERMANY.

A fresh chapter in connection with the electrical manufacturing industry in Germany and the supply of electrical energy has now been written by the Association of Electrotechnical Special Works, whose efforts to arouse the various Federal Governments as to the possible economic consequences to the small and medium-sized firms of the growing monopoly of the largest establishments, have previously been recorded in this journal. In the opinion of the Association, the danger exists of the creation of a monopoly also in the lighting and power supply business. The text chosen on the present occasion relates to the Bill introduced in the Prussian Parliament by the Minister for Railways, to authorise the substitution of electric traction on the Berlin City, Circle and suburban railways. The scheme provides for the purchase of power from two private works, which, it is said, are to be erected by the A.E.G. and the Siemens-Schuckert works respectively. The Association, in the course of a memorial on the subject, submits that the action of the Minister in deciding to requisition supplies of power from private works will strengthen the present monopolistic tendencies. The assertion is disputed that the cost of working would be greater if the State established power stations of its own, it being held that communal supply works are operated more favourably than private works, which are already burdened with intermediate profits. It is also contended that the same reasons are now adduced against the erection of State power stations for the railways as were brought forward many years ago against the nationalisation of the railways.

The memorial remarks that in the long run the State will be unable to refrain from securing an influence in the supply of electrical energy to the community if the establishment of a private monopoly is to be prevented. At present there are practically only two private undertakings which are engaged on the construction, financing, and working of electricity works for the supply of the public. In this connection the somewhat astounding statement is made that both concerns, partly as a result of the works in their own possession and partly through works in which they are decisively interested or which they have leased, control 35 per cent. of the public supply of electricity in Germany. Not only so, but the concerns are constantly endeavouring to extend their influence in this direction by the purchase or leasing of existing

works, so as to obtain in a monopolistic manner the sway over wide districts, particularly of an industrial character. If the Government authorities do not occupy themselves in good time with the action of the large electrical concerns, the Association states that the most important portion of the supply of electricity to the public will be handed over to a private group of manufacturers within a conceivable period.

It appears that industrial establishments are continuing in an increasing measure to close down their own generating plants in order to obtain a supply from overland central stations. Where such substitution takes place, it is prompted by the knowledge that the service will be cheaper. The Association, however, submits that the establishments thereby become absolutely dependent upon private enterprise not only for the supply, but also in regard to the price, of electrical energy, as the right of making special agreements with large consumers is reserved. It is thus possible for a private undertaking of this kind to make a differentiation in the charges made to different establishments, and to grant special advantages to those which are closely associated with it. In support of this argument, reference is made to the agreement concluded between the A.E.G. and the Berlin Electricity Works Co. on January 10th, 1899. The agreement provides for the sale by the latter to the former, at cost price, of all the energy required for its own purposes on the works site at Wilhelminenhof, on the Oberspree, where the cable factory in particular is situated. Apparently this agreement was the result of the inter-connection between the manufacturing industry and the supply business in the earlier days of the electric lighting era. This relationship has been developed in the intervening years, and is still in the foreground of activity.

We now reach an interesting point in respect of one of the important parts played by the German banks in connection with the manufacturing industry. According to the Association, agreements exist between one of the largest concerns in Berlin and the banks of issue both in Berlin and the provinces, whereby the banks participate to a certain percentage in the new issues of capital made by the company. In return, it is said, the banks are under the obligation to look after the company's interests on every opportunity, particularly in the case of those industrial establishments on whose boards of directors the banks are either represented, or are otherwise able to exercise influence. The Association declares that these circumstances frequently render it impossible for the electrical firms, other than one large concern, to obtain orders from industrial establishments which even have no connection with the electrical industry, as the banking interests use the whole of their influence, so that the orders devolve upon the large concern. Although the German Association must accept the responsibility for these statements, it is a well-known fact that the banks in general possess immense power in connection with industrial establishments in that country. If their demands are not conceded, they may refuse credit or decline to float fresh share or loan capital, or they may bring pressure to bear in various other ways. A remarkable instance of the latter class occurred slightly over five years ago, when the directors of a leading iron and steel company were definitely opposed to the company becoming a constituent of the German Steel Syndicate. So great, however, was the influence of the banking interests that the directors were over-ridden, and the company compelled to accept membership. But the present year has witnessed the collapse of that portion of the syndicate which controlled the particular products made by the company, and the latter is now free, as are many others, to develop these manufactures without the restrictions to which they were subject until several months ago.

The Association of Electrotechnical Special Works further contends that it is impossible to reject the idea that in connection with the extension of private ownership of central stations, differential treatment will be meted out between those industrial establishments which do not belong to the sphere of interest of the electrical concerns, and those which are associated with it, and that the latter group will receive more favourable terms of supply than their competitors in the former group. The memorial also refers to the great competitive advantages in relation to other supply works that would be conferred upon private supply works by the possession of State contracts for the delivery of the energy required for the operation of the Berlin railways, and it submits that the State Railway Administration, in the circumstances, should establish Government generating stations for the purpose. It now remains for time to show whether the Prussian Minister for Railways will take any action in regard to the representations made on behalf of the electrical firms of lesser importance than the great concerns. Generally speaking, the State in that country is more or less friendly disposed towards monopolies, in contradistinction to the welfare of the minor branches of any industry, on the ground that the consolidation of interests tends to greater stability in trade and greater uniformity in the degree of employment. The owners of the ordinary iron and steel rolling mills discovered this fact several years ago when they approached the Government with complaints regarding the price-cutting and monopolistic policy of the large steel works, which in the meantime have become still larger. Since then the potash industry has been converted into a legally constituted monopoly; the Westphalian coal trade is also threatened with Government intervention in the event of failure to renew the Ruhr Coal Syndicate, for the reason that the collapse of the combination, it is held, would shake the foundations of the coal and iron and steel industries; and the only hope remaining for the continued independence of the electrical firms of lesser importance in that country would appear to lie in Government action. It is, however, exceedingly doubtful whether anything could be done, even if the Government desired to take any measures other than those already adopted in regard to the prevention of monopolies, in respect to contracts for installations to be connected with electricity supply works. The question of a State monopoly of electrical manufacturing and the supply business, was raised unofficially a few years ago, but it failed to make any progress, and is at present outside the limits of probability or practicability. The only State monopoly sought for in the near future is the control of the petroleum trade—if it can be accomplished—against foreign interests.

BUSINESS NOTES.

Market Quotations.—CORRECTION.—In our "Market Quotations" last week the prices of phosphor bronze were incorrectly given. They are as follow:—

Phosphor bronze, plain castings, 1s. 2d. per lb.
" " rolled bars and rods, 1s. 2d. per lb.
" " rolled strip and sheet, 1s. 2½d. per ton.
White anti-friction metals, £45 to £230 per ton.

Cork Foundation Plates.—THE KORFUND CO. has recently received a number of orders for insulating machines against the transmission of vibration and noise, with their cork resilient foundation plates. These include Diesel engines of 550, 525, 200 and 120 H.P.; lift motors; a number of gas engines of from 3½ to 26 H.P., and several motor-generators.

Catalogues and Lists.—MESSRS. WALLACH BROS., LTD., Royal London House, Finsbury Square, London, E.C.—New list describing and stating prices of the "Pat" patent valve, asbestos packed cock and other steam fittings.

THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—Illustrated pamphlet briefly describing, admirably illustrating, and giving prices and dimensions of, the Nernst projector lamps, models "G" and "H" self-lighting, and model "G A" not self-lighting, which they hold in stock in London.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Advance copy of pamphlet No. 121 (eight pages) giving a complete specification and illustrations of their single and polyphase alternators (pattern HJ).

MESSRS. S. WOLF & CO., 115, Southwark Street, London, S.E.—Seventy-two-page catalogue relating to their various portable electric tools. The contents are descriptive with illustrations, prices, code-words and other particulars being tabulated. In the several sections the following are covered:—Electric hand drills and reamers, electromagnetic drilling machine, electric carriage drills, and electrically-driven grinding and polishing machines. Copies of the catalogue will be sent on application.

MESSRS. D. H. BONNELLA & SON, LTD., 58 and 60, Mortimer Street, Cavendish Square, London, W.—Four-page illustrated and priced circular (No. 401) dealing with mouthpieces, whistles and brass connections for speaking tubes.

MESSRS. W. GEIPEL & CO., St. Thomas Street, London, S.E.—Pamphlet relating to aluminium electrical conductors.

Messrs. Simplex Conduits, Ltd., London and Birmingham —Mailing card giving prices, &c., of Hope's Bi-metal fuse wire, of which a sample length for testing is attached to the card.

The Accessories Manufacturing Co., Ltd., 11, Dean Street, Oxford Street, London, W.—Large catalogue of electric light fittings, those shown being typical examples of those to be seen at the new showrooms that they have just opened at the above address. The showroom has been opened by arrangement with Messrs. Samuel Heath & Sons, Ltd., for whom they are sole agents for the London, and the Southern, Western and Eastern Counties. The catalogue before us is printed on art paper throughout, and the contents are divided off into sections dealing respectively with electroliers, ceiling fittings, pendants and hall lanterns, adjustable pendants and bed and dining room fittings, brackets, table and piano standards, floor standards, Newel and other standards and billiard fittings. All classes of designs and finishes are represented, and the examples shown include some very fine pieces of work.

Messrs. Veritys, Ltd., 28, King Street, Covent Garden, London, W.C.—Export publication No. 715 (eight pages) giving illustrated particulars and prices of ceiling fans, ironclad switches, house-service fuses, cooking sets, radiators, lantern fittings, and also cut-crystal glass fittings.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Sheet No. 400 describing and giving prices and dimensions of the firm's totally enclosed limit switches for cranes, hoists or lifts.

Messrs. Laurence, Scott & Co., Ltd., Gothic Works, Norwich. —Illustrated leaflet describing their new "Scott" electric motor-car starter and generator.

Messrs. Boving & Co., Ltd., 9½, Union Court, Old Broad Street, London, E.C.—Twelve-page pamphlet containing descriptions, illustrations, and price particulars, of their mechanically-operated turbine and engine, tachometers, tachographs, and speedometers and revolution counters (Dr. Horn's patents).

Messrs. Richard Pape, Ltd., Belvedere Works, Belvedere, Kent. —Pamphlet giving practical hints to users of the "Fors" accumulators.

The Lux Candle Co., Ltd., 36, Whitfield Street, London, W.— Leaflet showing their latest type of candle lamp with Barlock cap, which, when screwed down, keeps the lamp perfectly straight, the rubber washer keeping the candle steady and preventing rattling.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Four-page leaflet giving latest prices of "Gral" wire lamps, "Gral" patent wire Continental lamps, and B.T.-H. carbon lamps; also an abridged list of accessories, including "Gral" arc fittings, Holophane reflectors, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—16-page list (No. FN 1,610) containing illustrations and prices of a variety of fittings for shop and street lighting, railway station, warehouse and other service. The lines shown include lanterns, reflectors and inverted fittings for Osram lamps, from 25 c.p. to 1,000 c.p., wireless china "Striplite" and ordinary metal "Striplite," window bracket and shelf clips, advertising lanterns for shop windows and doorways, and "Highfield" outdoor fittings.

The "Z" Electric Manufacturing Co., Ltd., Orient House, New Broad Street, London, E.C.—Large and very effectively coloured hanging showcard of "Z" lamps, one of these lamps being suspended from an ostrich feather, the legend below reading, "Two of the lightest things known."

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—New "Wotan" lamp list (No. WL 3), of 16 pages, with the now familiar coloured frontispiece. The list contains particulars and prices of all types of these lamps at present on the market, including 10-c.p. lamps for both high and low-voltage circuits and for low voltages only (20 to 135), a range of 5-c.p. lamps. In the list prices are printed in very bold type. Among the details included are "Goliath" E.S. holders, and matt obscuring lacquer. Some views are given of street, stage, and other lighting. We have also received from the firm a folder containing particulars of the various advertising material (relating to Wotan and tantalum lamps) that they are prepared to supply to their trade customers in connection with their advertising campaign during the present season. A number of small illustrations are included showing the literature that is available and its sizes. There are cut-out and other folders, postcards, also inflated balloons, plaster models, and other advertising display novelties.

Bankruptcy Proceedings.—Joseph Arthur Procter, late electrician, 17, The Boggs, Allerton, Bradford, late 64, Bradford Road, Frizinghall, Bradford, and late 6, Birklands Terrace, Shipley, Yorkshire, and 20, Cecil Terrace, Great Horton, Bradford.—The first meeting of creditors in this matter was held last week at the Official Receiver's Chambers, 12, Duke Street, Bradford, when the statement of affairs showed liabilities amounting to £115, and a deficiency of £98. The failure was attributed to executing contracts under cost, through inexperience. It was decided to leave the matter in the hands of the Official Receiver, who will act as trustee.

Thos. Topping, electrical and mechanical engineer, Southport.— A first and final dividend of 4s. 10d. in the £ is payable on November 19th, at the offices of the Offical Receiver, 11, Dale Street, Liverpool.

Liquidations.—The British Vitrite Works (Swan's Patents), Ltd.—A meeting of creditors is called for November 20th, at 20, Cannon Street, Birmingham.

Fleetwood and District Electric Light and Power Syndicate, Ltd.—Creditors of this company must send particulars of their debts, &c., to the liquidator, Mr. W. Cash, 90, Cannon Street, E.C., by December 20th.

Book Notices.—"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 9. September, 1912. Brussels: E. Bruylant. Price 1.75 fr.

"*Memoirs* of the College of Science and Engineering Kyoto Imperial University." Vol. III, Nos. 9, 10, 11 and 12. March-July, 1912. Kyoto, Japan: The University.

"Boletin de la Sociedad de Fomento Fabril." September 1st, 1912. Santiago, Chile: The Society.

"*Bulletin* of the American Institute of Architects." Vol. XIII, No. 2. July, 1912. Washington: The Institute.

"Magneto and Electric Ignition." By W. Hibbert. Price 2s. net. "The Practical Telephone Handbook." By J. Poole. Price 6s. net. "Wireless Telegraphy and Telephony." By W. J. White. Price 2s. 6d. net. 1912. London: Whittaker & Co.

"A Primer of the Internal Combustion Engine." By H. E. Wimperis. 1912. London: Constable & Co., Ltd. Price 2s. 6d. net.

"*Journal* and List of Members of the Institution of Municipal Engineers." Vol. IV, No. 14. October, 1912. London: The Institution. Price 1s.

"Manual for the Use of Fire Brigades." London: National Fire Brigades' Union. Price 2s. 6d. net.

"Electrical Photometry and Illumination." By Hermann Bohle. 1912. London: Chas. Griffin & Co., Ltd. Price 10s. 6d. net.

"Mésure de l'Equilibre des Circuits Téléphoniques." By M. Béla Gáti. Paris: A. Dumas.

"Where Circulation Means Value."—In the course of an article in the *Newspaper Owner and World* on "Things that Matter in Advertising," Mr. Field Somers says:—

"Advertising is, I suggest, at its best where a spiritedly-conducted and genuine newspaper in which such advertising is placed reaches, with as little overlapping and waste as possible, the public or the interest at which the announcement is specifically directed. An essential household requisite is insufficiently advertised if *any* newspaper that is regarded as the best in its locality—however restricted—is left out of the scheme. An article or service, on the other hand, that only appeals to a comparatively limited class, should obviously be confined to the newspapers or journals appealing to that class, and, for choice, to the best and strongest of them, irrespective of the charge made. By cutting off all fictitious or doubtful values, money is saved to devote to the real and ascertained values, and it is at this point that advertising ceases to be a gamble and becomes a scientific business proposition."

Trade Announcements.—We are informed by the sole British representative of Messrs. K. & Th. Moller G.m.b.H., of Brackwede, patentees of the Moller air filter, that they have practically completed arrangements for manufacturing in this country.

Mr. S. Utting, of 4, St. Mary Axe, London, E.C., has been appointed sole British representative for the firm of Louis Prat, Paris, the patentee and maker of the Prat induced draught apparatus.

Messrs. Thompson & Co., of 68A, Lincoln's Inn Fields, London, W.C., have been appointed sole British agents for Ateliers Constructions Electriques, Jeumont, who make specialities of bare copper wires, trolley wire and aerial cables.

Messrs. Watlington & Co., Ltd., are carrying a stock of 10,000 Britannia metallic-filament lamps at their new warehouse, Britannia House, 43, Milton Street, London, E.C. At the same new premises they will also carry a stock of transmission line and supply material, and of electric lighting and heating accessories. The firm have issued a small eight-page pamphlet giving particulars and prices of the Britannia lamps of from 5 to 100 Hefner c.p.

For Sale.—The patents, plant, machinery and effects of the British Vitrite Works (Swan's Patent), Ltd., Wolverhampton, are offered for sale as a going concern. The Mersey Railway Co. has for sale a quantity of arc lamps and accessories. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Arabia.—What is described as the first installation of electric lighting in Arabia has lately been completed in the Palace of the Sultan of Oman, in the south-eastern portion of the country.

Australia.—The Provincial Electric Development Co., of Victoria, has decided to install an electric lighting system at Carrum, Aspendale and Chelsea. Current will be obtained from the company's power station to be erected in Dandenong in connection with the lighting of that town. The company has also lighting and power supply projects in hand for the towns of Daylesford, Dunolly and Shepparton.—*Mining and Engineering Review.*

Belfast.—The report of the city electrical engineer on the various sites for the proposed new generating station in connection with the electricity department was submitted to the Electricity Committee last week. In order to compare the advantages of the sites Mr. Bloxam estimated for the construction and operation of a 24,000-H.P. plant in each case, with the cable connections to a ring main encircling the city. Taking an output of 30 million units, 46,875 tons of coal would be required, lighterage amounting to 4d. to 4½d. per ton. In the result the Glen-

toran site shows capital expenditure amounting to £181,983, plants on the other sites costing from £190,000 to £200,000. In arriving at the cost, cables are reckoned at £14,290 assuming that they would be carried round the Albert Bridge, but this figure would be reduced to £6,574 in the event of a proposed new bridge being built, giving a shorter route. Mr. Bloxam further reports upon the comparison of Diesel engine and steam turbine-driven alternators for a total output of 9,000 KW. in connection with the electricity extensions. He invited the British and Continental Diesel engine manufacturers to quote for Diesel driven alternators of 3,000 KW. output, or, failing this, for smaller size units, and received offers from two Continental firms to build an engine of the size asked for, while British makers would only quote for much smaller units at a very much greater cost per KW. He, therefore, assumed that if Diesel engines were ordered they would be purchased abroad, and would be of the two-cycle six-cylinder type running at 136 R.P.M., and taking the price of these units as the basis of comparison with that of steam turbines purchased from the present contractors, he found that the increase in capital outlay for 9,000 KW. of Diesel plant compared with steam plant, based on the overload rating in each case, including buildings, was £24,560, or an annual charge of £1,535 for interest and sinking fund for 25 years' loan. Regarding the question of fuel, he concludes that if coal is to cost 14s. and oil 70s. a ton, the Diesel plant might fairly be estimated to save ·046d. per unit generated, or £2,875 per annum, on an output of 15 million units. Therefore, deducting the increased capital charges from the diminished fuel cost, £2,875 minus £1,535, an annual saving is shown of £1,340. In addition, there would be a saving in boiler-house wages of possibly £600 per annum, or in all a total saving of £2,000 per annum. This would, however, only accrue after the extensions had increased by 9,000 KW., or say in the year 1920, and assuming the cost of oil did not increase. He is of opinion that in spite of the saving in cost of production which calculation shows, the Committee would be well advised not to embark on a Diesel engine scheme until an engine of the size required has been built and run satisfactorily, and, further, until some evidence is available to show that supplies of oil can be obtained with certainty, and that the price of it is not going to increase owing to the big demand for it that will arise for marine purposes. The Committee adjourned consideration of both reports for a fortnight.

Bournemouth.—The T.C. has invited the Bournemouth and Poole Electricity and Supply Co., Ltd., to tender for the lighting of the Undercliff Drive for five or seven years, with 200-C.P. lamps.

Canterbury.—The T.C. has fixed a charge of 4½d. per unit for current supplied to motors to be used in connection with gas compressors for lighting purposes.

Cheltenham.—On Monday next, at the Town Hall, a "Modern Home Exhibition" will be opened, and will close on the following Saturday, 23rd inst. The electrical section has been organised by the Corporation (Mr. W. J. Bache, borough electrical engineer), and it will contain a representative display of appliances for electric lighting, heating, cooking and power.

Cleckheaton.—At a meeting of the Electricity Committee, a report was read in which it was stated the estimated loss on the quarter's working was £464, and the estimated loss for the half-year £819. On account of this loss, which has been greatly due to the increase price of coal, a Sub-Committee has been appointed to consider a revision of charges.

Consett.—The Urban Council has opened negotiations with the Cleveland and Durham Electric Power Co. for the public lighting of the town in 1913. The company has also been asked to embody in the scheme terms for private lighting.

Continental Notes.—SPAIN.—It is stated that an American named Parrish intends to set up a hydroelectric station on the River Ebro, capable of generating 1,000,000 H.P. Three dams will be constructed, in the neighbourhood of the Cities of Barcelona, Tarragona and Valencia, respectively. The works are being directed by American engineers, and are expected to be completed by 1914.—*Revue Pratique de l'Electricité.*

RUSSIA.—The British Vice-Consul at Hangö reports that there are small waterfalls or rapids in the south of Finland which are suitable for the development of electric energy for tramways, light, and power, &c. The Vice-Consul adds that want of capital has, up to the present, hindered the exploitation of this water power for industrial purposes: he is willing to supply information to British firms who would interest themselves in this matter.

The Moscow municipal authorities propose to construct a new electric power station in that city at a cost of about £316,000. The station is to be equipped with turbine engines using superheated steam.

The Ministry of Trade and Industry has confirmed special regulations for the use of electrical equipments on oilfields.—*Board of Trade Journal.*

The rolling mills of the Société Metallurgique du Midi de la Russie, at Kamenskoie, are now electrically operated. The power station comprises four sets of 2,000-H.P. gas engines and dynamos.

SWEDEN.—A power station of 5,000-H.P. capacity has just been completed by the Sikfors Kraft Aktiebolag at Pitealfau, near Pitea, North Sweden. The water-power of the Sikforsen Falls is utilised, the water being conveyed to the station by two pipes, about 550 ft. in length. At present about 4,000 H.P. is being utilised, the current generated being transmitted to the town of Lulea, 27 miles away, at a pressure of 40,000 volts.

FRANCE.—La Société des Forces Motrices du Rays is the name of a company which has lately been formed in Lyons, with a capital of £10,000, to put down a plant to utilise the Ray Falls at Romeyer (Drome) in the generation of electrical energy for lighting and power purposes.

Chile.—The construction has been authorised of an electric generating station to supply the City of Tocopilla with electric light.

Dover.—The T.C. has unanimously adopted a report by the borough engineer and electrical engineer for the conversion of a number of streets at present lighted by gas, to electric lighting. The scheme provides for replacing 265 gas lamps, costing £973 a year; the electric light would cost £818 for all-night lighting, and £707 for half-night use. The report further details the expected saving by various electric lighting proposals during the year, amounting to £1,108, which, even after meeting the capital cost of carrying out the work, leaves a margin in hand of £160. In 1913-14, including proposed further conversions, a saving of £1,496 will be shown.

The Corporation Electricity Committee, on November 5th, considered a request from the British Electrical and Allied Manufacturers' Association that figures relating to tenders should not be published, on account of the information becoming known to foreign firms. The chairman (Mr. Hobday) expressed the opinion that it was unwise to publish prices, but Ald. Lewis said that the public demanded it, and they could not get away from that. Mr. Beaufoy remarked that those who tendered liked to know the prices, as they were a guide for the future. They simply accepted them in a lump sum, and no details were published. Ald. Lewis said that if people were afraid of foreign competition, they should have Tariff Reform. The Town Clerk explained that only the names and amounts of tenders were reported to open Council. It was eventually decided to defer the matter, in order to see if other manufacturers made a similar request.

Dublin.—A L.G.B. inquiry will be held on November 19th into the application by the T.C. for sanction to loans of £34,000 for electricity purposes. On the 20th inst., a similar inquiry will be held at Pembroke, the Council being desirous of borrowing £9,000 for electric lighting works.

Felixstowe and Walton.—The U.D.C. has accepted the tender of the Suffolk Electricity Supply Co., Ltd., for public lighting, for seven years, within a radius of 150 yards from the back of the Promenade, on terms to be agreed.

The Council has decided to apply to the L.G.B. for a loan of £4,052 for additional plant for the electricity works and extensions for three years.

Harwich.—The T.C. has sealed an agreement to take electricity for its pumping station from the Great Eastern Railway Co. for ten years, at 1½d. per unit, and it is estimated that the cost of working the station by electricity will be from £300 to £350 a year, as against over £500 by the present steam power. The capital cost of the scheme is placed at £950.

Hazel Grove and Bramhall.—The U.D.C. has approached the Stockport Corporation with a view to obtaining a supply of electricity, and a canvass of the district is being made for likely consumers. The Council has already decided to obtain a provisional order in the next session of Parliament empowering it to provide electric light for street purposes and for private houses, and applications for additional gas lamps in some of the districts have been deferred pending a report as to the probable date of commencing the supply of electricity.

Hemsworth (Yorkshire).—The Little Houghton P.C. has partially arranged with the Houghton Main Colliery Co. to supply electricity for the lighting of the township.

Heston-Isleworth.—Demonstrations of electric cookery, organised by the Electricity Department, in conjunction with the "Tricity" cooker manufacturers, and carried out by Mr. F. S. Grogan, have attracted large audiences to the Council House.

Hoddesdon.—The U.D.C. has informed the B. of T. it has no objection to the E.L. Order of 1901, held by the North Metropolitan Electric Supply Co., being revoked. The company itself has applied for the revocation.

Hove.—With regard to the suggested purchase of the undertaking of the E.L. Co. by the T.C., a large meeting of ratepayers held on November 7th decided by a large majority that "the purchase would prove disastrous," and recommended the T.C. not to proceed further with the matter.

India.—Karachi is at last to be illuminated by electric light. We hear that a leading Karachi firm has the matter in hand, and that on the necessary formalities in connection with the licence under the Electricity Act being completed, a company will be established in Karachi for the supply of electrical energy for all forms of lighting, for fans and for all industrial purposes. The prospectus will probably appear about the end of the year, and the new development may be expected to be seen in operation early in 1913.

Kendal.—The T.C. has applied to the B. of T. for permission to use overhead mains in order to supply current to the factory of Mr. Illingworth on Malt Kiln Hill.

Kingstown.—The electric light question was discussed last week by the Council, and a resolution dispensing with notice from the Dublin Southern District Electric Supply Co. of its inten-

tion to apply for a prov. order, was unanimously adopted. It was pointed out that Mr. Wm. Murphy had agreed to become chairman of the new company, and that the Dublin United Tramways Co. had no power to undertake lighting in the district.

London.—Hackney.—The borough electrical engineer in his report on the working of the electricity undertaking for the year ended March 31st last, states that the year's output amounted to 6,615,526 units, compared with 5,662,795 units for the previous year, or an increase of no less than 16·82 per cent. The total units generated amounted to 7,642,775, of which amount 2,239,920 were sold for private lighting and domestic uses; 3,389,726 for power and factory lighting, and 850,561 for public lighting, while 1,027,249 was used on the works. During the 12 months under consideration, the price obtained per unit for public lighting was 1·36d., this being more than sufficient to pay for the energy supplied. Having regard to the high load-factor of this class of supply, the engineer suggests that the price charged should in future be reduced to 1·2d. per unit, which would also cover the capital charges on the special public lighting cables, and that the carbons, repairs and maintenance, cleaning, lighting and extinguishing, be charged for at prime cost, with 10 per cent. added thereto to cover administration expenses. The financial result of the year's working was a net surplus of £8,950.

Lytham.—The U.D.C. is giving notice of its intention to apply to the B. of T. on or before December 21st next for a provisional order for the supply of electricity within the urban district. In connection with this matter, the Council has approved of the engineer's scheme, and has decided to acquire a plot of land, on lease, for the erection thereon of the proposed electricity works.

Nenagh.—The Urban Council has had under consideration for some time the advisability of installing an electric lighting plant for the town, and will at the next meeting appoint an electrical engineer to carry out the scheme.

Penmaenmawr.—The Urban Council has been notified by the Manchester engineers that, acting on behalf of a syndicate, it was their intention to apply to the B. of T. for an order authorising them to undertake the generation and distribution of electricity for public and private purposes over an area embracing parts of Llanfairfechan and Penmaenmawr, and desiring to ascertain the Council's attitude. The Council is already in possession of an E.L. order, and the letter was referred to the Roads and Improvements Committee.

Rochdale.—The Electricity Committee on Wednesday, last week, referred to a Sub-Committee for consideration and report, a scheme for further additions at the electricity works, involving an expenditure of about £30,000. Negotiations are in progress between the department and certain firms for a large supply of current, and this prospective demand, together with others already agreed upon, renders a further extension necessary. The Committee also approved terms for a supply of current in bulk to the Whitworth U.D.C.

Salford.—The B. of G. has deputed Mr. E. M. Lacey, the engineer engaged in connection with the electric lighting, to interview the Corporation with a view to obtaining the best terms for a supply of current, &c., for the electric lighting of Hope Infirmary. The board has also decided to ask Mr. Lacey to act, after completion of the installation, as consulting engineer, and to make quarterly tests and reports both at the infirmary and nurses' home at a remuneration not exceeding 25 guineas per annum.

Sheffield.—At the meeting of the Council on Saturday last, the Parliamentary Committee recommended the Council to instruct the Town Clerk to proceed with the remaining stages of the Corporation Bill now before the Select Committee of the House of Lords, and to endeavour to get the "electric fittings" clause, as allowed by the House of Commons' Committee, reinserted in the Bill. Ald. Cattell proposed as an amendment that so much as related to the Town Clerk being instructed to endeavour to get the electric fittings clause, as allowed by the House of Commons, reinserted in the Bill, be not confirmed. Dealing with what were supposed to be the special circumstances in the case, he maintained that the factory department had nothing whatever to do with the wiring and fittings department. No one would contend that the cost of motors had anything to do with the cost of the wiring and fittings department. The £2,000 profit they were told about was not a profit on the wiring and fittings department. At least £1,000 of it belonged to the revenue they got from the hire of motors. The officials of the Electric Light Department said on oath that nothing had been charged to the department for rent, interest or depreciation. It was a state of things one would not be surprised at when one considered the number of interests the head of the department had had to take under his wing. They wanted to simplify matters and consolidate their work, and put the department on a business foundation. His opinion was that they would gain by closing the department. Ald. Styring assured the Council that if they left the conduct of the Bill in the hands of the Parliamentary Committee, there would be no fear of losing it. If the wiring and fittings department was worth nothing at all, why did Ald. Cattell move to induce the Corporation to give up what was of no value to others? Very little cost had been incurred by the introduction of the clauses, and he maintained that the wiring and fittings department had cost £28,000. Councillor S. Roberts, jun., said that in all cases where the Corporation had been doing work at less than cost price, they had been making a loss and robbing the traders of their profits. Alderman Styring denied that the Corporation did work at less than cost price. Alderman Bennett said the question had nothing to do with municipalisation. That was settled when they purchased the undertaking years ago. The question before them was simply a business question and nothing else. He agreed with the Chairman of the House of Commons Committee, that under existing circumstances Sheffield ought to have the powers. They had to face things as they were, quite irrespective of what they would do if starting a new undertaking. Councillor Hobson said that no one suggested that the Corporation should go out of electric trading; they must have a wiring department to lay cables through the streets; it was commonly agreed that they should supply motors for hire, and they must wire and fix those motors. The whole question, therefore, resolved itself into whether some small portion of a complete business should be lopped off. He found that in the past the Corporation had carried on the business in the honest belief that they did so as successors in title to an existing business, and introduced no new competition. It did not seem to him precisely right that trade rivals should desire to peremptorily close down a substantial concern and one that was earning substantial departmental profits, without any payment for the goodwill, and without any proposal to take over the stock, but simply to shut the doors of a trade rival and annex the business and its goodwill. He hoped that the traders would seriously consider the situation before they persisted in their claim to annex some portion of the business of the Corporation without compensation by shutting it down on a technicality. On a vote the amendment rejecting this portion of the Parliamentary Committee's minutes was lost by 31 votes to 24.

South Africa.—The electric supply of the Muizenberg (Cape Province) Municipality, and also the recently inaugurated supply from Muizenberg to Wynberg Municipality, was interrupted on October 20th, and it was some time before the cause of the failure could be located. The supply to Wynberg is by three-phase 3,300-volt bare overhead cables, and has been in use only about two weeks. The cables are carried on 30-ft. iron poles from Muizenberg to Wynberg, and it appears that a European boy about 10 years old climbed to the top of one of the poles and touching the wires was instantly killed. The body of the boy lay across the wires for some time, as owing to the lateness of the hour, and the locality, it was difficult to communicate with the Muizenberg power station so as to have the current switched off.

The Cape Town Corporation Electric Lighting Committee has decided to reduce the price of energy for lighting purposes from the present price of 9d. net to a flat rate of 7d. net. This is made possible by the large increase in the demand; in 1908 a little over two million units were sold, and in 1911 this had been increased to 4,164,000 units, and further increased in 1912.

Southampton.—With regard to the Council's action several months ago abolishing slot meters and increasing the price per unit by ½d. in lieu thereof, the electrical engineer reports that the ½d. is not sufficient to cover the rental paid, and advises that the price per unit should be increased another ½d., making ¼d. in all, which would be, if anything, still slightly on the low side of the average account. He further suggests an increase of ½d. on the charges of the few prepayment installations connected, to bring the two classes into line. It has been decided to adopt the engineer's suggestions. Application is to be made to the L.G.B. for sanction to borrow £3,000 for general services. A letter has been received from the Itchen U.D.C., stating that it cannot consent to the application of the T.C. to supply electricity to the houses on the Chessel House Estate, also a further letter stating that the District Council has had under consideration a scheme for the establishment of an electricity supply undertaking for Itchen on the basis of taking a supply in bulk from the Corporation, and inquiring whether the Corporation would be prepared to enter into an arrangement for furnishing such a supply, and if so, upon what terms and conditions. The communication has been referred to the electrical engineer for a report.

Swindon.—In order to encourage cooking and heating by electricity, the T.C. has decided to supply energy to consumers of electricity for other purposes, at 1d. per unit, with no meter rental, where the revenue amounts to 25s. per annum. Cooking apparatus is to be let out on the hire or hire-purchase system.

Wednesbury.—The Corporation has received an intimation that the L.G.B. has sanctioned the borrowing of £3,700 for an engine, dynamo and accessories for the electricity works.

Woodbridge.—The U.D.C. has informed the Rural Districts Electric Undertakings, Ltd., that when the present contract with the Gas Co. expires, it will, no doubt, be prepared to consider a tender from the company for public lighting, and that if a reasonable, sufficient and efficient service is maintained by the company, the Council will not apply for a prov. order for 21 years from January 1st, 1913, and will not support any other application for an order during that period.

York.—The T.C. proposes to have the electric light installed in the Municipal Asylum Cottages, and to supply energy to the occupiers at 9d. per week during the six winter months, and 6d. per week during the summer. The first lamps are to be provided free

TRAMWAY and RAILWAY NOTES.

Barnsley.—The Barnsley Electric Traction Co. has decided to introduce a service of motor-'buses to link up some of the populous districts with the tramway system.

Bournemouth.—The general manager of the tramways (Mr. I. Bulfin) has just issued his report for the half-year ended September 30th. The total receipts were £53,749; expenditure, £27,891; gross balance, £25,855. These show an increase on the gross balance for 1912 of £2,548 over the corresponding period of 1911, and £2,631 over the same period of 1910 (the centenary year). In regard to expenses, slight increases are shown in a few cases, viz., in the power station, due to increased units generated and coal strike charges; in the payment of wages, due to the Government insurance; in the permanent way, due to renewals; in the car equipment, due to painting and overhauling. These are amply made up for by the decreases under other heads, as the net result of a decrease of £1,000 in expenses on the six months' running clearly proves. During the six months ending on September 30th, 3,628 more car-miles were run and 200,000 more passengers carried than in the corresponding period of 1911, yet the claims paid for accidents and damage for the six months of 1912 were less than half those for the corresponding period of 1911.

The chairman of the Tramways Committee reported to the T.C. that a director who had power to act for the Electricity Supply Co. had approached him on the question of the price of current outstanding between the Council and his company, and the latter was willing to supply the energy required by the tramways at 1·6d. for the first 250,000 units; 1·5d. for the second 250,000 units; 1·4d. for the third 250,000 units; 1·3d. for the fourth 250,000 units and remainder.

Canada.—The Canadian Express Co., which operates in connection with the Grand Trunk Railway system, is trying an interesting experiment with electrically driven collecting and distributing lorries. Five of these vehicles have been delivered by the makers for use in Montreal and Toronto. The new vehicles have a speed of 10 to 12 miles an hour, and will travel for 45 miles on a single charge. Two of them are built with a carrying capacity of one ton, and the other three can convey loads of two tons each. Electricity was chosen in preference to other forms of motive power on account of the greater simplicity of the mechanism and the ease with which the vehicles can be operated by any intelligent man who has been used to driving horses.

Chesterfield.—The General Purposes Committee has passed a resolution favouring the obtaining of Parliamentary powers for establishing railless trolley vehicle routes as proposed in a joint report by the electrical engineer and borough surveyor. The routes proposed extend to Temple Normanton, three miles; Clay Cross, two routes, each four miles; from Whittington Moor to Unstone, two miles; to Brimington, two miles; and other routes from Whittington Moor and to Bolsover.

Continental Notes.—FRANCE.—The Compagnie des Chemins-de-fer du Midi, like all the rest of the companies which serve mountainous regions (the Paris-Lyons-Méditerranée and the Paris-Orléans), has at last decided to enter on the path of progress. In September last it inaugurated the funicular line of the Superbagnères mountain, above Luchon, and it now announces its intention to undertake a similar work on the slopes of the Pic du Midi de Bigorre. As already notified, the same company has decided to introduce electric driving on the Toulouse-Bayonne main line lying between Montréjeau and Pau and on all its dependent Pyrenean branches, or over 270 km. of lines now in working. With this end in sight, large generating stations are under construction at Soulom, near Pau and at Eget in the Aure valley, 1,000 metres above sea level. The latter will necessitate the construction of an underground canal 15 km. long, to lead the waters from the Oule torrent and from an artificial lake to be created at a height of 1,800 metres, as far as Hourquette d'Arrouyes, where it will fall 750 metres into the Neste d'Aure valley, near the Eget railway line crossing. This head of water is expected to yield 20,000 H.P. A beginning was made with the works in the winter of 1910-11, amid the deep snows of these almost inaccessible regions, 20 km. from the base at Arreau.—*Revue Pratique de l'Electricité.*

The construction of an electric railway between Villefranche and Vernet-les-Baines, in the Pyrenees Orientales, has received the sanction of the Ministre des Travaux Publics.

The T.C. of Villeneuve, in the Department of Seine-et-Oise, have passed a resolution favouring in principle the establishment of a service of electric auto-'buses between Brunoy and Villeneuve.—*Revue Pratique de l'Electricité.*

A scheme for the establishment of a railless system of electrical motor vehicles between Thonon-les-Baines and Morzine, in Upper Savoy, is at present under consideration.

AUSTRIA.—Among the electric railway projects lately announced are a line from Malé to Fucina, 16·6 km. long, estimated to cost 2,414,000 kronen: a light line, for passengers only, from Karlsbad and Fischern to Rohlau, promoted by the Vienna firm, P. Hagyi, Risto & Co., and a line connecting Lana, Burgstall and Oberlana.—*Elek. und Maschinenbau.*

A great extension of the electric tramway network is projected in Prague, the capital of Bohemia. Some five new lines are to be constructed, with a rearrangement of the supply cables. The K.K. Statthalterci has just completed the official investigation of the scheme.—*Elek. und Masch.*

ROUMANIA.—The commission nominated by the T.C. of Bucharest to draft the terms of the auto-'bus concession to be offered for public competition, has issued its recommendations, which now await the approval of the City Council. It recommends a concession for 19 years 11 months, dating from January 1st next, giving a right to serve the whole of the streets of the city, with a reservation of any routes which the concessionaire may neglect for other concessionaires. Any kind of driving power may be chosen, but should electricity be adopted, current must be supplied by the communal electricity works, which is bound to furnish at the same price as that accorded to the Communal Tramway Society. It is stipulated that at the end of the concession, the rolling stock shall become the property of the commune.—*Revue Pratique de l'Electricité.*

SWITZERLAND.—Trials of electric working have been made on the almost completed Lötschberg line, and have given excellent results. Motors of 1,250 H.P. are used, each locomotive being equipped with two, giving a total of 2,500 H.P.—*Revue Pratique de l'Electricité.*

RUSSIA.—In view of the overcrowding of the St. Petersburg tramcars, it is proposed to put a further 75 cars and 42 trailers in circulation, and to enlarge the central power station. The total cost is estimated at about £81,600.

Good progress is being made with the conversion of the horse tramways in the town of Kischinew to electric traction, and it is hoped to re-open the lines to traffic at the beginning of the new year. The company has contracted with the municipal electricity undertaking for the supply of the necessary current.

East Kent.—The East Kent Light Railways Co. is applying to the B. of T. for an order authorising the construction of a light railway from Little Mongeham to Eastry, which is in the new colliery area.

Halifax.—A special meeting of the T.C. was held on Monday, when Mr. C. F. Spencer, chairman of the Tramways Committee, moved a resolution authorising that steps be taken to promote a Bill in the ensuing session of Parliament to enable the Corporation to extend its tramways within and outside the borough and to provide and run motor-'buses outside the borough. In the borough, the Corporation seeks powers for tramways from Spring Hall Lane to Mount Tabor and Wainstalls, from Skircoat Road, to Siddall, and from Siddall to Messrs. Morton's works. Outside the borough, it is proposed to construct and work tramways from Brighouse to Rastrick, from Bailiff Bridge to Brighouse, West Vale to Staniland, Triangle to Ripponden, and another route to Elland; also to construct tramways to run goods traffic to and from the railway goods yard in Church Street and Messrs. Morton's brickworks at Siddall, and Messrs. Oates & Green's works, Ellen Royde. Mr. Spencer said Messrs. Morton's traffic was about 37,000 tons per annum, and that of Messrs. Oates & Green about the same. The Council approved of powers being obtained for the making of these tramways and to construct and work the following tramways in Brighouse: In Huddersfield Road and Bird's Royd Lane, from Huddersfield Road to the L. & Y. Goods Station.

The R.D.C. has approved of the scheme of the Huddersfield Corporation for the proposed tramway to Fixby, and has also consented to the proposed tramway extension from Fixby to Elland.

Keighley.—In connection with the scheme for the introduction of a railless traction service from Ingrow Bridge to the junction of Hebden Road and Leeds Road, Haworth, a distance of about 1¾ miles, the Tramways Committee has provisionally accepted the offer of Trackless Trolley, Ltd., London (see "Contracts Closed" column) for the overhead equipment, on condition that the company (1) sends on trial for a period of three months, free of charge, one of its cars, which the Corporation shall be at liberty to use in regular service during that time; (2) supplies one of its own men to drive the car at an inclusive cost not exceeding £3 per week; and (3) gives an undertaking that in the event of its system being considered unsatisfactory by the Corporation, it will, without further charge, alter the overhead equipment and adapt it to such other method of current collection as the Corporation may require.

Little Hulton (near Bolton).—The U.D.C. has appointed a Sub-Committee with power to settle an agreement with the South Lancashire Tramways Co. as to terms under which the company will construct tramways along Manchester Road and Clegg's Lane.

London.—Formal notification has been given by the L.C.C. to the City Corporation that it has decided to seek powers in the next session of Parliament to construct tramways from Southwark Street over the proposed new St. Paul's Bridge, to a point near the most western end of Cheapside.

Morley.—The Corporation has decided to promote in the next Session of Parliament a Bill authorising, among other things, the construction of a railless trolley system from Drighlington, through Gildersome, Morley, West Ardsley, East Ardsley and Stanley to Wakefield.

Newcastle-on-Tyne.—At a special meeting of the T.C. on the 9th inst., Mr. J. H. Rodgers, chairman of the Tramways Committee, moved a motion that the Council apply for a provisional order for an extension of the city tramways; one section from Heaton Road terminus to Stephenson Road, and another section from the centre of the city to the High Level Bridge *viâ* Westgate Road and St. Nicholas Street. The motion was agreed to.

Newcastle.—The Tramways Committee has recommended the City Council to accept a tender for the supply of steel rails of German manufacture, at a cost of £3,660, being £500 less than that of a Leeds firm.

Northampton.—As the result of an appeal the Assessment Committee has reduced the assessment of the Corporation tramways undertaking from £6,105 to £5,100.

Oldham.—It was reported at a meeting of the Tramways Committee last week that there was a profit on the tramways undertaking for the six months ending September 22nd, of £3,060.

Ripley.—The scheme for the construction of tramways from Nottingham to Ripley has been before a special meeting of the U.D.C., when, after full consideration, it was decided to object to the proposals, on the ground that proper allowance for road widening had not been made. It appears to the Council that the roads are to be widened at the expense of the footpaths in certain places; the Council thinks that land should be acquired, and proper widenings made. The objection is to be forwarded to the Board of Trade.

Sheffield.—It is proposed to purchase four motor-omnibuses for the purpose of providing an experimental service in the Meadow Hall district.

Tripoli.—The Acting British Consul-General at Tripoli reports that, according to the local Press, the "Società Romana di Tramways" is on the point of obtaining a concession for the construction and working of electric tramways in that city. The length of the proposed lines will be about 9¼ miles.

Wolverhampton.—The annual report of the Tramways Committee to the Council gives the following statement of traffic receipts, &c., for the first six months of this financial year, ended September 30th last, as compared with the same period last year:—1912, 587,957 miles, 5,945,404 passengers, £27,205 receipts, 11·105d. per car-mile; 1911, 580,883 miles, 5,796,366 passengers, £26,732 receipts, 11·045d. per car-mile. From the figures given, it will be noted (states the Committee) that the total revenue for the electric cars during the period referred to shows an increase of £473, or ·060d. per car-mile, whilst the number of passengers carried is 149,038 in excess of last year. The result is considered highly satisfactory, having in view the extraordinarily fine summer of last year, together with the heavy traffic on the cars during the Coronation festivities. The receipts on the Wednesfield route show a decrease of £109 for the six months, which is attributable to the motor char-a-banc service on the Cannock Road, many passengers now travelling by these vehicles who had hitherto travelled on the Wednesfield cars.

York.—The B. of T. has granted the T.C. an order for the extension of the electric tramways in Bishopthorpe Road.

TELEGRAPH and TELEPHONE NOTES.

Automobile Wireless Telegraph Plants.—The Star Engineering Co., Ltd., of Wolverhampton, are building a number of 20-h.p. six-cylinder chassis for the Marconi Wireless Telegraph Co., Ltd.; the machines are specially designed to carry a wireless telegraph outfit. An electric generator is carried at about the centre of the chassis, and is driven off the engine of the car through gearing, which can be engaged and disengaged.

Brazil.—The firm of C. Lorenz, of Berlin, have erected a wireless station at Lagoa, near Florianopolis, on the Island of San Catarina, Brazil, for communication with shipping between La Plata and Cape Horn; also for communication with Rio Grande do Sol and Rio Janeiro. The Vielton system is employed.—*Der Tag*, Berlin.

British Telephones.—In the Parliamentary papers Mr. Joynson-Hicks recently asked the Postmaster-General if he would state the number of subscribers' stations, direct exchange lines, and main exchanges taken over from the late National Telephone Co., Ltd., at January 1st, 1912, and the number of subscribers' stations, direct exchange lines, and main exchanges existing on the General Post Office telephone system at December 31st, 1911, for London and for the provinces, respectively. Mr. Herbert Samuel, in reply, said the figures asked for were, approximately, as follows:—Post Office.—London: 79,835 exchange stations; 53,208 direct lines; 30 exchanges. Provinces: 39,160 exchange stations; 30,334 direct lines; 1,125 exchanges. National Telephone Co.—London: 131,506 exchange stations; 74,827 direct lines; 62 exchanges. Provinces: 393,934 exchange stations; 297,608 direct lines; 1,545 exchanges.

Iceland.—The Parliament of Iceland has voted 88,000 marks (£4,400) for the establishment of a wireless station on Reykjavik, the capital of the island.

Registration of Telegraph Companies.—Sir Wm. Bull asked the President of the Board of Trade whether he was aware that the Registrar of Joint Stock Companies had recently refused to register the memorandum and articles of companies proposing to carry on the business of telegraphs and telephones unless the memorandum of association contained the words "so far as it lawfully can or may," and that a considerable number of persons had lodged memoranda and articles of association not containing these words, and, owing to the refusal of the Registrar to register the companies, they had been put to expense in altering the provisions of the memorandum of association; whether this action had been taken by the Registrar in pursuance of a request from the Postmaster-General and in order to protect his monopoly and that of companies which had been licensed by him; whether there was anything in breach of the Postmaster-General's monopoly in the mere registration of such a company; whether he was aware that such a company could be properly formed and carry out a large part of the business of a telegraph and telephone company without infringing such monopoly; and whether it was possible for a company to obtain a licence from the Postmaster-General to carry out any part of its work for which a licence was required until it had been registered; and under what authority the Registrar of Joint Stock Companies adopted the course in question.—Mr. Buxton replied that the action of the Registrar of Joint Stock Companies in asking for the insertion of the words in question was originally taken at the suggestion of the Postmaster-General. The matter was receiving further consideration. Later it was announced that the practice in question had been stopped.

The Telephone Transfer.—Former employés of the National Telephone Co., now in the Post Office service, held a mass meeting in Clerkenwell last week to protest against the manner in which the Post Office classification had been applied to them. Other meetings took place simultaneously in various parts of the country. A resolution was passed affirming loyalty to the Postmaster-General, but asking that the promises which he had given in the House of Commons might be carried into effect.

United States.—The Government has voted £220,000 for the erection of a number of wireless stations, mainly to establish communications with ships of the American Navy in distant seas. The chief station at Arlington, near Washington, is to have three towers, one rising to a height of 210 metres, and the other two to 150 metres each. It is also intended to erect stations on the Panama Canal; at Tutuila, one of the Samoa Islands; on the Island of Guana, and on Luzon, in the Philippines.—*Elek. Zeitschr.*

The German wireless station which is in course of construction at Sayville, on Long Island, near New York, about which alarmist rumours have been circulated in American journals, is being built by the Atlantic Communication Co., an American capitalised company, although an offshoot of the Berlin Telefunken Gesellschaft. Its objects are, as its name implies, to exchange communications with ships on the Atlantic passage, and it is in no wise connected with the German Government. Contrary to the statement that it has been surreptitiously erected, the American officials have been duly informed of every stage of its progress from the beginning.—*Elek. Zeitschrift.*

Wireless Telegraph Patents.—We are informed by Messrs. Marconi's Wireless Telegraph Co., Ltd., that Messrs. Siemens Bros., acting in England for the Telefunken Co., have admitted the validity of the Marconi Co.'s patent No. 7,777 of 1900, and arrangements have been come to by which the actions brought by each company are now at an end.

Imperial Wireless System.—On Tuesday last week the Select Committee examined Mr. Llewellyn Preece, who stated that during the last 13 years, as a member of the firm of Preece, Cardew & Snell, he had been largely responsible for the wireless telegraph work in connection with the Crown Colonies, which included the erection of 11 stations. The Marconi Co. was the only one that had had continuous experience in commercial working over 2,000 miles, and seeing that the matter was one of urgency, he considered the Postmaster-General did right in accepting the tender of that company. If he had waited for the Poulsen or the Goldschmidt systems to prove their capabilities, a delay of at least another year would have been incurred. Although the Poulsen system had been in existence for six years, it was only during the last few months that it had become a competitor of the Marconi system. He had checked the price quoted—£60,000 per station—with the cost of plant dealt with by his firm, and considered it a low one, as the actual cost would be £58,700. Seeing that there was no profit on the capital outlay, that State messages were to be free, and that the Postmaster-General could determine the agreement at any time, he considered the royalty of 10 per cent. on gross receipts a reasonable one. The Postmaster-General would have power to fix the rates without reference to the company, and he could substitute other plant at any time; in the latter event only about £10,000 per station would be sacrificed, the rest of the plant being available for other systems. After six stations had been erected, the Government could have additional stations erected by any other company capable of doing the work. The witness had never done any work for the Marconi Co., but he had visited the Clifden station, which worked well and handled a large traffic. The Poulsen people had not proved their claims, or put forward a complete scheme which could be compared with the cost of the Marconi system. He had not placed orders with the Telefunken or other companies, as their tenders had not been satisfactory. He was not a Marconi man. In 1907 the company was in a rotten condition. The company held the master patents for wireless telegraphy, and the probability was that any new invention would infringe those patents. The Lodge patent was more important than the Marconi patent. He had a high opinion of the Poulsen system, but the Marconi Co. stood alone as regarded long-distance working. The former could only work at night between San Francisco and Honolulu. The Marconi Co. stood to lose on the cost of the stations; as they held the master patents,

they were entitled to the 10 per cent. royalty. There was no alternative for the Post Office but to use the Marconi system; the Admiralty experts had had no experience of working over 2,000 miles. He did not think the Poulsen system could be worked without infringing the Muirhead-Lodge patent. He regarded the terms of the agreement, by which no payment would be made until the stations were working satisfactorily, as very stiff.

The witness was further examined at great length regarding the technical details of the various systems. He considered the duplex better than the simplex system for the Imperial scheme. If the Poulsen system later proved to be the better, and the Government resolved to adopt it, but wished to use the Marconi amplifier, he suggested that they should throw out the Marconi system entirely, substitute the Poulsen, and then open negotiations with the Marconi Co. for the use of the amplifier. In that case they would not have to pay the 10 per cent. royalty. He had witnessed a demonstration at the Marconi Co.'s works of transmission at the rate of 50 words a minute from Cheltenham to Poldhu. The company had a great deal of work in hand, apart from this contract. There was no reliable automatic long-distance system at work anywhere. If the Government had waited for the Poulsen Co. to demonstrate their ability to transmit by day over a distance of 2,000 miles, there might have been a delay of 2 or 2½ years before the Imperial system was established.

On Monday the sitting was resumed, and Sir A. F. King, re-called, stated that the Marconi Co. first reduced the period of monopoly to five years, and later dropped it altogether. If they used none of the Marconi patents, the royalty ceased. It was possible that the company might control the situation by purchasing other people's patents. It would be impossible to prevent movement in the shares of any company that got a Post Office contract. He had never put down the great movement in Marconi shares to the Post Office contract; the company had then just acquired the business of the United Wireless Co. in the United States. It was of no consequence to the Government to know whether the company had secret processes or not, so long as they were doing the work. It was not the duty of any Government department to secure an unfair bargain; if a man had a patent he was entitled to be paid a royalty. The Treasury could have made use of the patents and fixed their own price, but at the Post Office they did not negotiate on that basis. Moreover, the Post Office wanted the benefit of the Marconi Co.'s experience, and desired that the company should be responsible for the stations. He did not agree with the chairman of the company when he stated in July that the company had acquired so many patents that the Post Office could not help using some of them. The stipulation in the agreement that any Government department not a party to the agreement should not receive any information as to the working of the system was inserted in order that in the event of the Indian Government or Australian Government not desiring to be parties to the agreement, no secret information connected with the working of the Marconi installations should be communicated to them. The original clause stated that information should not be imparted to other departments, and the Admiralty decided that they could not possibly accept the clause. The Treasury regarded the tender not as a binding contract, but as being "conditional on satisfactory arrangements being made subsequently." The Post Office undertook to obtain the advice of the Marconi Co. before using any new invention, but was not bound to follow that advice. The company would have to refund the £40,000 paid on each station if satisfactory working was not accomplished after six months' working. The company sent messages 3,000 miles mainly overland, between Italy and the East Coast of Africa.

On Wednesday, Mr. Beech Thompson, President of the Federal Wireless Telegraph Co., of U.S.A., gave evidence to the effect that his company, using the Poulsen system, had transmitted messages overland a distance of 1,150 miles in the daytime. Between San Francisco and Honolulu, a distance of 2,400 miles oversea, they regularly transmitted about 3,000 words a day, mainly Press messages, during the night. They had sent messages after 10.30 a.m. (about 8 at Honolulu). They had occasionally picked up messages from greater distances—one from a ship in the Atlantic, 8,000 miles away. The U.S. Government had made his company offers for the patents, but he had not accepted them. He could cover a distance of 2,000 miles. The distance between Ireland and Canada was only about 1,700 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. Six electrically-worked luggage lifts for the Aberdeen Joint Station Committee. Engineer, Mr. J. A. Parker, 80, Guild Street, Aberdeen.

Australia. — South Australia. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

Victoria.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

Austria.—Vienna.—December 9th. Tenders are called for, for sundry telegraph materials, milliampere-meters, coloured crayons, &c. Particulars and samples from the K. k. Zentraltelegraphen depôt, Erzherzog Karlstrasse 131, Vienna XXI.

Perjamos, Torontal.—December 31st. Tenders are required for a concession to establish an electric light service. Particulars of the Vorstehung der Grossgemeinde Perjamos.

Birmingham. — November 25th. Electric motors (various), for the City Electric Supply Department. See "Official Notices" November 8th.

Dartford.—November 27th. 500 yd. of concentric lead-covered and armoured cables and accessories, and renewal of lighting battery, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Dover.—November 18th. Two centrifugal pumps, with electric motors, for the Corporation baths. Mr. W. C. Hawke, Borough Engineer, Maison Dieu House, Biggin Street.

France.—Paris.—The State Railway Administration intends to acquire a quantity of high-pressure three-phase electric cable, 15,000 volts, 3 × 100 millimetres section, for the interiors of traction and lighting sub-stations. Particulars from the Bureaux des Services électriques, 1e division, 43 Rue de Rome, Paris.

Tenders are required for the supply of fittings for call and central telephone offices (call plates, bells and receivers, &c.), in 12 lots. Particulars from the Sous-Secrétariat d'Etat des Postes et Télégraphes, Paris.

Greenock.—November 18th. One 3,000-kw. three-phase turbo-alternator, with condensing plant, &c., for the Corporation. See "Official Notices" November 1st.

Hull.—November 20th. Electric lighting, fittings and bells, for the Teachers' Training College, Cottingham Road, for the Education Committee. Particulars (deposit £1 1s.) from the City Treasurer, Guildhall, Hull. Drawings to be seen at the Education Offices, Albion Street.

London.—November 19th. Electric lighting, bells and telephones, at the "Strand" School, Brixton Hill, S.W., and electric lighting at the Southern Outfall Works, Crossness, Abbey Wood. See "Official Notices" November 8th.

Manchester.—November 19th. The Corporation Tramways Committee is inviting tenders for (*a*) tramway rail bonds; (*b*) block tin: (*c*) karri or jarrah wood paving blocks. Specifications, &c., J. M. McElroy, General Manager.

November 19th.—One 650-800 kw. rotary converter and transformer, for the City Electricity Committee. See "Official Notices" November 8th.

New Zealand.—December 16th. Two 150-b.h.p. Diesel engines, two 100-kw. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only. Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

January 6th, 1913.—Switchboards, for the Auckland Harbour Board. See "Official Notices" to-day.

Rathmines.—November 25th. Electric wiring of the new Carnegie Library and Technical Institute, for the Rathmines and Rathgar U.D.C. Specification 10s. 6d., can be seen or obtained at the Council's electricity works.

Spain.—November 28th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment of a telephone exchange in the town of La Carolina (province of Jaen), and for the working of the same during a period of 15 years.

November 21st.—The municipal authorities of Roquetas (province of Tarragona) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Roquetas (Tarragona).

Vich.—The T.C. are ready to receive offers for a concession to light the town by electricity for a period of 10 years, dating from April 16th, 1913. Deposit, 6,000 pesetas. Particulars from the Municipio, Vich.

Jaen.—November 20th. Offers are invited for a concession for 15 years to establish and work a telephone system. Particulars of the Civil Governor.

York.—November 16th. Construction of about 1¼ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Admiralty and Australia.—The Walsall Electrical Co., Ltd., have received an order from the Admiralty for 18 moving coil meters, switchboard type, and one from the Australian Postmaster-General for two moving coil switchboard type instruments, and 11 portable instruments.

Brussels.—The city authorities have entrusted to the firm of J. G. Hiroux & Co., of Brussels, representing the Kabelwerk Duisburg (Germany), the contract for the supply of high-pressure armoured and rubber-insulated cables during the period up to December, 1914, which was the object of the adjudication held on August 9th last.

Felixstowe and Walton.—The U.D.C. has accepted the tender of the D.P. Battery Co., Ltd. for a battery, duplicate booster and arrangements for balancing, at £1,117, subject to sanction to a loan being obtained.

Fort William.—For the electric lighting plant, electric bells and the heating installation in connection with the improvements and additions on the Estate of Dalness for Sir Schomberg Macdonnell, the contract has been placed with Messrs. Mackenzie and Moncur, Ltd., of Edinburgh.

Greenock.—Messrs. Kennedy, Stark & Co., Glasgow, have secured the contract for the electric lighting of a new school at Greenock.

Keighley.—The T.C. Tramways Committee has recommended the acceptance of the tender of Trackless Trolley, Ltd., of London, to construct the necessary overhead equipment for the proposed trackless trolley system from Ingrow Bridge to the junction of Hebden Road and Leeds Road, Haworth, a distance of 1 mile and 1,400 yards, for £1,610, subject to certain conditions.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract to supply the whole of the metal-filament lamps to be used on an electric railway in London for the ensuing 12 months.

L.C.C.—The Highways Committee has accepted the tender of Messrs. Rownson, Drew & Clydesdale, Ltd., at £77, for 12 hand scrapers and spare parts required for cleaning tramway conduits. The tender of Alldays & Onions Pneumatic Engineering Co., Ltd., at £135, for a pneumatic power hammer for Poplar permanent way depôt, has also been accepted. Messrs. B. and S. Massey quoted £155.

Mansfield.—The Guardians' Building Committee received the following tenders for the electric lighting installation of the institution :—

J. Woolley	£998
B. Meggitt	980
Mansfield Engineering Co.	955
Furse & Co.	886
Buck (Manchester)	884
Farr (Nottingham) .. .. .. (recommended)	795

Tram Rail Contract at Newcastle-on-Tyne.—At a meeting of the City Council on the 9th inst., Mr. Rodgers, chairman of the Tramways Committee, moved that a contract with Messrs. Dick, Kerr & Co., for tram rails be sealed. He said that the matter was not on the agenda, but it was important that the contract should go through. Mr. Stephenson objected, whereupon Mr. Rodgers said if Mr. Stephenson blocked the way he must take the responsibility of the price going up. They wanted 500 tons of rails to complete the work they had to do. The tender of Dick, Kerr & Co. was £3,362 for a kind of rails used by several large municipalities and found satisfactory—Bradford, Leeds, Sheffield, Manchester, Hull, Bristol, &c. It was the lowest tender. The motion having been duly seconded, Mr. Stephenson moved as an amendment that the Council accept the tender of a local firm, Messrs. Walter Scott & Co. The firm, he said, from whom the Tramways Committee proposed to accept the rails, got them from Germany. The difference between their price and the local firm was only £462, or 10 per cent. He believed in the matter of tramway rails they could get better workmanship and better materials at home than if they went abroad. Mr. Woolf seconded and pointed out that English workmen were paid on a better scale than foreign workmen. Mr. Mayne called attention to the fact that Sandberg rails were agreed by experts—such as the city engineer and the city tramways manager—to be better than English standard. The amendment was negatived, and the motion for sealing agreed to.

Paisley.—The T.C. Advisory Committee has had under consideration offers received from the British Electric Transformer Co., Ferranti, Ltd., and Messrs Siemens Bros., Ltd., for the supply of transformers. After consideration had been given to the engineer's report upon the offers, it was agreed to recommend that of the first-named firm for acceptance, provided the temperature rise of their transformer could be brought down to 80°.

Stockport.—The Stores Committee of the Guardians has accepted the tender of the Co-operative Wholesale Society, Manchester, for the supply of 1,000 "Osram" metallic-filament lamps for burning on 240 volts, at the Stepping Hill Hospital.

Sunderland.—The following installation contracts have been secured by Messrs. F. Reid, Ferens & Co. :—Sunderland Picture Empire, also West-End, Murton, Haswell and Southwick Picture Empires ; Queen's Hotel and Arcade, and Easington Private Consumers' Line.

Watford.—The tender of the British Westinghouse Co., Ltd., has been accepted, at £3,004, by the U.D.C., for a steam alternator and regulator ; as has also that of the Electrical Construction Co., at £103, for a switch panel.

West Hartlepool.—Messrs. Venner & Co. have received an order for equipping the West Hartlepool Tramways with Chamberlain & Hookham car meters.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, November 16th. At 1.30 p.m. Meeting at the Royal Technical College, Glasgow.

Association of Engineers-in-Charge.—Saturday, November 16th. At 3 p.m. Visit to the generating station of the Charing Cross, West-End and City Electricity Supply Co., Marshgate Lane, Stratford, E.
Saturday, November 23rd.—At 7.30 p.m. At the St. Bride's Institute, E.C. Discussions on "Electrical Wiring," and "Electrical Faults and How to Find Them."

Electro-Harmonic Society.—Monday, November 18th. At the Holborn Restaurant. Concert. Ladies' night.

Institution of Electrical Engineers (Western Section).—Monday, November 18th. At the South Wales Institute of Engineers, Cardiff. Address by the chairman, Mr. W. A. Chamen.

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 19th. At 7.30 p.m. At the University, Manchester. Paper on "Earthed *v.* Unearthed Neutrals on Three-phase A.C. Systems," by Mr. J. S. Peck.

Illuminating Engineering Society.—Tuesday, November 19th. At 8 p.m. At the Royal Society of Arts. Report by the Hon. Sec. on progress during the vacation. Papers on "A New Illumination Photometer," by Mr. H. T. Harrison ; "Photography in Illuminating Engineering," by Messrs. J. S. Don and V. H. Mackinney ; and "Miners' Lamps."

Institution of Electrical Engineers (Students' Section).—Wednesday, November 20th. At 7.45 p.m. At the Institution, Embankment, W.C. Opening address by Dr. A. Russell.

Royal Society of Arts.—Wednesday, November 20th. At 8 p.m. First meeting of the session. Opening address by Lord Sanderson, chairman.

North-East Coast Institution of Engineers and Shipbuilders.—Friday November 22nd. At Newcastle. Conversazione.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, November 18th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 19th.—"B" Company. Recruits' instruction, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Thursday, November 21st.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 22nd.—"D" Company. Recruits' instruction, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Saturday, November 23rd.—A week-end run will take place for "D" Company at Fort Coalhouse, East Tilbury. Dress : Service dress, putties, waistbelts, and greatcoats will be worn. Parade at Fenchurch Street Station at 3 p.m., the train leaves for Low Street at 3.25 p.m. ; railway tickets will be issued by the senior N.C.O. at 3 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

Explosion at an Electricity Works.—It is reported that on November 4th an explosion occurred at the Guernsey Electric Light and Power Co.'s works, situated at the North Side, St. Sampson's. Several employés were near a 250-H.P. Diesel oil engine, when suddenly there was a loud explosion, and the cylinder cover flew upwards. Holes were torn in the roof by the flying masses of metal, which were later found in fragments in the vicinity, parts of the valve gear being 20 yards from the building. The cause of the accident is unknown. The engine was driven by crude oil. It had been installed within the last 18 months.

A Hove Report.—A lengthy report on the Hove Electric Light Co.'s undertaking, by Messrs. Handcock & Dykes, has been received by the General Purposes Committee of the T.C. This details the present position of the undertaking, and suggests, in the event of the Corporation deciding to purchase it, that Diesel engine sets of about 600-KW. capacity should be installed to take the long-hour load, leaving the present condensing engine plant for the peak load. The cost of the alterations and extensions would amount to about £20,000. The report also refers to the possible expansion of the undertaking through the acquisition of street lighting and traction supplies.

The Ferrantians' Dinner.—Mr. A. Bruce Anderson presided over a representative gathering of Ferrantians, past and present, at a dinner at the Waldorf Hotel on Wednesday last. Mr. S. Z. de Ferranti was the guest of the evening, and in response to the toast of his health, he recalled many of the trials and troubles of the pioneer days of electricity generation and supply. Among other things, Mr. Ferranti remarked that the hot bearings which made electrical work a nightmare in the early eighties, were accepted practice in modern turbo-electric plants, the difference being one of forced lubrication. Speaking of electrical marine work, he thought that there might in time be a return to A.C. supply on shipboard. All the early shiplighters were A.C. machines. Mr. H. W. Kolle proposed "The Ferrantians over Seas," and referred to the good work they were doing in many countries abroad. Mr. E. W. Martin, who is in this country from Valparaiso on a short business trip, replied, and hoped that his next visit to the mother country would fit in with a meeting of Ferrantians. Electrical engineers abroad had few opportunities to foregather. Mr. Morton Beales proposed "The Chairman" in a humorous speech, and Mr. Anderson modestly replied.

China and British Engineering.—With reference to the article by Mr. E. T. Williams, of Hong Kong, appearing in our last issue, the author now sends us the following extracts from a leading article which appeared in the *Hong Kong Daily Press* last month: "For a country of China's size a total foreign trade of 849,000,000 taels, or roughly £113,000 000 sterling, is absurdly small. It is but slightly more than the trade of Switzerland. Therefore, it is no exaggeration to say that the possibilities of foreign trade with China are *stupendous*, and we may anticipate from the policies enunciated by the leaders of public opinion that this trade will develop by leaps and bounds, though not, we should add, until China is able to borrow the necessary foreign capital to put her house in order and lay the foundations of solid economic development. During the last decade China's foreign trade has doubled. Mr. Dingle, the author of 'China's Revolution,' predicts that in the next decade, if peace prevails, 'it must be trebled.' This is considered a cautious and conservative estimate. Mr. Dingle also says, 'No right thinking Englishman, no matter how optimistically he may view the general situation of Great Britain's trade in the Chinese Empire, can deny that British trade does not expand proportionately with what is to be done and with what others are doing."

In the Canadian Lumber Camps.—In many parts of the Colonies and foreign countries electrical engineers are naturally faced with all sorts of difficulties in carrying out installation work. All sorts of unusual situations have to be met, which demand all the resources and ingenuity of the engineering mind in securing

H.T. Switchboard in Canadian Lumber Camp.

the desired result with unaccustomed materials. In this connection we have been favoured by a correspondent with a photograph illustrating a standard high-tension sub-station switchboard (2,000 volts), as used in Canada. We are assured that this type of board is very often met with in the Lumber Camps there. Perhaps some of our readers in the distant parts of the earth may be able to furnish other and equally interesting photographs of this kind of thing?

The Bradford Strike.—At a concert held last Friday, under the auspices of the Bradford Branch of the Electrical Trades Union, Mr. Kinniburgh, the organiser of the Union, in referring to the strike of Bradford electricians, stated that the men had commenced electrical contracting on their own account, and were prepared to accept work for electric installations. He urged other trade unions to give their electrical work to the men on strike and also to support them morally. He announced that no definite settlement had been arrived at, and although one master had granted the advance asked for, the Electrical Contractors' Association had forced him to withdraw his offer.

Miners' Safety Lamps.—In a notice dated October 24th, the Home Secretary has authorised the use underground of apparatus for the relighting electrically of safety lamps, provided that the apparatus complies in all respects with, and is used in accordance with, the regulations in force with respect to the use of electricity underground, that the station where the apparatus is used is not within a distance of 200 yd. of any part of the working face, and that when not in use the apparatus shall be kept securely locked, and no person shall have any key or contrivance for unlocking the apparatus, other than a person appointed in pursuance of the Coal Mines Act. The chief provisions at present in force are as follows:—A safety lamp must not be relighted except at an appointed station, which must not be in a return airway; by a competent person appointed in writing by the manager for the purpose; and after examination by the person appointed. The lamp must also be examined by the appointed person after being relighted, and before being issued. The apparatus must not be used in any part of a mine where inflammable gas, although not normally present, is likely to occur in quantity sufficient to be indicative of danger. The apparatus must be so constructed, installed, protected, worked and maintained as to prevent danger so far as is reasonably practicable, and in particular must be so constructed as to preclude the accumulation of explosive gas within it.

Smoke Nuisance.—Scarborough Electric Supply Co., Ltd., were summoned before the local justices the other day for causing a chimney at their premises to send forth black smoke in such quantities as to be a nuisance. The Bench intimated that they were satisfied the smoke was black smoke within the meaning of the Act, but they thought that, in view of the uncontradicted evidence of the defendants, the company were entitled to the second exception stated did not apply. The solicitor who had acted for the company said he had no further instructions, and added that the company were now entirely unrepresented, also remarking that it was the first time he had known a defendant dismissed, then brought up again and convicted. Ultimately the case was adjourned until to-day (Friday).

Oban Corporation Appeal Dismissed.—According to the *Oban Times*, Sheriff-Principal M'Clure has issued his decision in an appeal by the defenders against a decision of Sheriff Wallace in an action brought by John Campbell, gasfitter and electrician, Stafford Street, Oban, against the Provost, Magistrates and Council of the Burgh of Oban. It will be remembered that the pursuer sought to interdict the defenders from selling or supplying electric light lamps, shades and wire, which the pursuer alleged the defenders had done without having any Parliamentary powers for so doing, and thereby trading to the prejudice, and against the interests, of the pursuer's business.

In granting interim interdict against the Town Council, Sheriff Wallace stated in his note that the question of controversy was one solely of law and of the defenders' powers under the Acts and their Order to engage in the supply of electric fittings, to the detriment of pursuer's business and to his patrimonial loss. No doubt defenders denied that they were engaged in the business or trade of selling or supplying electric fittings. But they admitted that they had been in the habit of supplying, and no doubt intended to continue supplying, their customers or persons who took their supply of electric energy from them with the fittings and adjuncts incidental to the use of that supply, and that, it appeared to him, was sufficient evidence on their part to enable him to decide the real question in controversy between the parties without further delay and expense. He thought, therefore, no good could be served by allowing a proof.

Against this decision the defenders appealed, and the Sheriff-Principal heard the parties' agents debate before him. His Lordship has now dismissed the appeal, adhered to the interlocutor of the Sheriff-Substitute, remitted the cause for further procedure, and found the appellants liable to the respondent in the expenses of the appeal.

Canada.—H.M. Trade Commissioner for Canada reports that a firm at Montreal desires to get into communication with British manufacturers of electric and hydraulic elevators, with a view to securing their representation in Canada. The name and address of the firm may be obtained by British makers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. Any further communications regarding the inquiry should be addressed to H.M. Trade Commissioner, 120, Board of Trade Building, Montreal.—*Board of Trade Journal.*

Institution and Lecture Notes.—Institution of Electrical Engineers (Students' Sections).—The ninth annual dinner of the London Students' Section will take place at the Trocadero Restaurant on Saturday, December 14th, at 7.30 p.m. The President, Mr. W. Duddell, F.R.S., will be present. The secretary of the Institution (Mr. P. F. Rowell) has issued particulars of the arrangements made for the different sections for the coming session. Mr. J. C. Rennie is chairman of the London Section, and the papers that are coming forward for attention are as follows:—

November 20th, opening address by Dr. A. Russell; and at later meetings the papers will be as under:—Discussion on "Passenger Transport in London"; Mr. J. C. Rennie, on "Sterilisation by Electric Light"; Mr. E. T. Driver, "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors"; Mr. C. H. Goulden, on "Low and Mixed-Pressure Turbine Plant"; Mr. G. W. P. Page, on "Some Problems of Electricity Supply"; Mr. S. W. Mills, on "Electrical Heating and Cooking Apparatus"; Mr. T. J. Hornblower, on "Alternating-Current Railway Signalling."

The Manchester Students' Section, which had its opening address on Tuesday last, has as its chairman the chairman of the Local Section. The arrangements for the coming months are as follows:—Mr. S. N. C. K. Whitehead, on "Individual Electric Driving in a Modern Weaving Shed"; Mr. S. Burns, on "Electric Theatre Installations"; Mr. A. N. Haworth, on "Automatic Circuit-Breakers"; Mr. S. E. W. Taylor, on "Street Photometry"; Mr. A. T. Robertson, on "Winding of Electrical Machinery"; Mr. H. R. Constantine, on "Time Limits"; Mr. W. Parry, on "Practical Testing of Transformers."

The Glasgow Students' Section held its opening on November 5th with a paper on "The Corporation of Glasgow Electricity Works" by its chairman, Mr. W. W. Lackie. The papers for remaining nights are:—Mr. A. C. Howard, on "Ampere-hour Meters for Direct Current"; a debate; Mr. N. C. Woodfin, on "Electrical Estimates and Opportunities"; Mr. N. McCaskill on "Illumination."

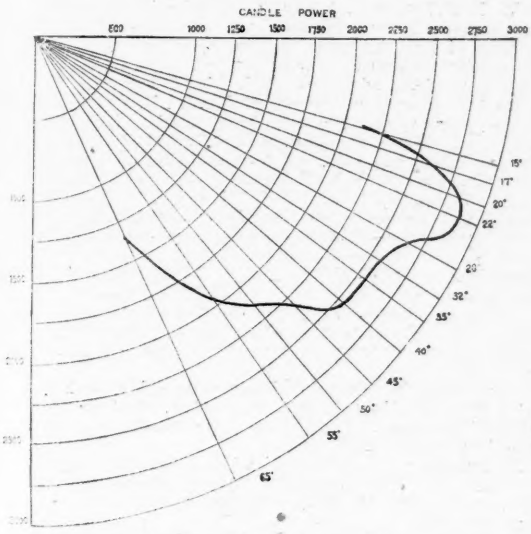
The Newcastle Students' Section, of which Mr. T. C. Christianson is the chairman, met on October 28th, for a paper by that gentle

man on "Rotary Converters." Other arrangements for this Section are as below:—Mr. P. Grice on "Heating and Cooling of Electrical Machinery"; Mr. H. D. Phelps on "Notes on Design and the Running of D.C. Sub stations"; Mr. J. C. Hacking on "Phasing Out of A.C. Apparatus"; Mr. J. S. Ellis on "Application of Electricity to the Lighting of Residences, Business Premises, and Factories"; Mr. V. O. Haddock on "Notes on a Single-phase Traction System"; Mr. E. Wyatt on "Regulation of Pressure and Continuity of Supply of Electricity under Various Aspects"; Mr. R. C. Philipp on "Notes on the Operation of Three-phase Transformers"; Mr. H. V. Henniker on "Cascade Connections."

ROYAL SOCIETY OF ARTS.—The new Session of this Society will be opened on Wednesday evening next, November 20th, by Lord Sanderson, G.C.B., K.C.M.G., chairman of the Council, who will deliver an address and distribute the medals awarded last session. Dr. F. Mollwo Perkin will read a paper on "Synthetic Rubber" on December 11th. A course of Cantor Lectures will also be delivered by Mr. C. R. Darling on "Methods of Economising Heat" on Mondays, December 2nd, 9th, and 16th.

BELFAST ASSOCIATION OF ENGINEERS.—On November 1st a paper was read on "Long-distance Transmission of Power" by Prof. Stanley.

Holborn Street Lighting.—The accompanying illustration shows the distribution of the light given by one of the larger type of tungsten lamps used for lighting the main streets of Holborn, in conjunction with the reflector and lantern designed by Mr. J. S. Highfield (see ELEC. REV., page 644). It will be noticed that the maximum intensity of illumination is produced at a small angle with the horizontal, in accordance with the requirements for uniform illumination, the candle-power at 22° below the horizontal being 2,875, while at 65° it is 1,350. The tungsten lamp has a



HOLBORN STREET LIGHTING.

marked advantage in this respect, as its maximum candle-power is delivered in a horizontal plane, and with the aid of a suitable reflector, the part of the space midway between two lamps can be adequately lighted. Further curves, showing the intensity of illumination at intervals between the lamps, will, no doubt, become available shortly, and will be awaited with interest.

Fatalities.—DINGWALL.—The recent accident near Dingwall, which resulted in the death of two persons had a sequel in three actions raised in the Court of Passage at Edinburgh, against the Strathpeffer and Dingwall Electric Co., Ltd., but on Tuesday Lord Dewar was informed that the cases had been settled. The plaintiffs were Donald Ross, foreman ploughman, Fodderty Farm, near Dingwall, who sued for £500 in respect of the death of his 10-year old daughter; Mrs. Ross, his wife, who claimed £1,000 for personal injuries; James Mackenzie Grant, ploughman, Humbuston, near Dingwall, and the other children of Mrs. Jessie Grant, widow, who sued for £750, in respect of the death of their mother. Mr. Ross accepted £100 and costs; Mrs. Ross, £200 and costs; and the Grants, £125 and costs.

MANCHESTER.—An inquest has been held into the cause of death of Wm. Henry Pickwell (24), electrical engineer, who died after receiving an electric shock at the Stuart Street Station of the Manchester Corporation on Nov. 6th. According to the *Manchester Evening News*, it was stated in the course of the evidence that Pickwell, who recently passed the final examination for B.Sc., was engaged in working a switchboard when the accident occurred. He had been instructed to go behind the board to see whether a connection was properly established between some wires. Three of these wires were "live," and witness said it was impossible to make them dead. Pickwell was warned about the wires. He was seen to fall after a flash, and a fellow-workman thought the metal-covered electric lamp which he carried had come into contact with one of the wires. He had thus received a shock at 3,000 volts, which would kill him instantly. The Coroner said that it was rather a foolhardy thing to go into a place of danger without the rubber gloves provided for the purpose of insulation. The witness, Thomas Wallace, also an electrical engineer, said no more than a casual glance behind the switchboard was necessary for the work in hand. He had no need to touch the wires, and the accident seemed to have been due to over-zealousness. There was a regulation that panels of the switchboard must be made "dead" when certain work was going on, but he did not think it applied to what they were doing at the time. Mr. Arthur Edwin M'Kenzie, chief assistant engineer to the department, said it was quite possible that Pickwell overbalanced in leaning over to look at the wires. He appeared to have grasped a wire to save himself. A verdict of "Accidental death" was returned.

DUBLIN.—Last Friday an inquest was held into the death of Robert Shannon, 23, an electrician, who received an electric shock while at work at the Irish Picture Palace Theatre that was in course of erection at Ellis's Quay. Deceased's brother, who gave evidence, said that he and deceased were engaged by Messrs. Curran Bros., of Belfast, in putting electric light into the theatre. Deceased had been only six months at the business. He could not give any explanation of the occurrence. J. Cheevors, who was working on the same landing as Shannon at the time, said that the electric light went out and deceased "went to fix it." He heard him call out and moan and he then fell back. He got up again, and witness asked him what was the matter, but he made no reply. The hospital surgeon said that Shannon was dead on arrival at the hospital. All the organs were healthy, but there was a slight abrasion, which he considered a burn, between the shoulders. Death was due to a very strong shock. Mr. H. Alward, inspector of installations, said that the pressure in the building was 200 volts. He had had 25 years' experience, and he is reported to have said that "he never heard of anyone being killed by a 200-volt current," and that he had received 200-volt shocks himself without injurious effects. "So far as I could see, it would be an impossibility for him to get killed by the current which was on. The majority of people might take a live wire in their hands in Dublin without any injurious effect. I would not hesitate to do so myself." He found that there was no leakage, and could not find anything wrong. The jury found a verdict in accordance with the doctor's evidence.

LONDON.—On Thursday last week the inquest was held on Mr. J. C. Moreton Thompson, aged 52, a solicitor, who died in an electric bath. A Marylebone jury found a verdict of "Death by misadventure," and added a rider that electric baths should be periodically inspected. According to the report in the *Standard*, the widow said that on Sunday her husband was in perfect health. He had taken electric baths at the same place for some time, and had never complained of ill-effects.

Mr. M. D. Dudman, of 8, Cavendish Place, masseur and medical electrician, said that he had no medical degree. He had practised at Cavendish Place for four months. He only treated patients after medical recommendation. He first met the deceased at Harrogate; afterwards Mr. Thompson came to him in London and said that he would like to take the same treatment as he had had at Harrogate, which consisted of electric baths, massage and vibration. He had had nine treatments in London, and an electric bath in every case except one. All patients were treated according to medical instructions. Quite recently Mr. Thompson said he felt better than he ever had done. He put the deceased in a light bath and worked him up to 120°. Mr. Thompson was only 10 minutes in that, and then the witness put him in a water bath for cooling. Through the water he administered an electric current of 400 milliwatts, which was equal to 10 volts, but only about two volts would go through the body. The deceased had only been in the bath six minutes when the telephone-bell rang, and the witness went across the room to answer it. Before he could do so the deceased gave a great shout, and the witness, running back, found him in a sitting position and vomiting. The witness at once tried artificial respiration and sent for a doctor. The water bath was of porcelain, with a teak top. All the electric wires were insulated. There were seven conductors at the side of the bath properly insulated. The deceased could have got no shock through touching the taps of the bath.

The Coroner: Could the deceased get a shock from the water itself?—Yes, if the lamp on the switchboard crossed current and there was a broken filament. In that case the deceased would get the full dose from the main of 240 volts. As a matter of fact, the lamp had been broken. That was the first thing he noticed when the deceased called out. When he went to the telephone the lamp was all right. The deceased could not have touched the lamp. The witness's only theory of the cause of the shock was that it was due to a cross current of the guide lamp. He was satisfied that there was no fault with the lamp at all. The effect of a shock of that description would be immediate action upon the heart. As far as the witness could judge, Mr. Thompson was dead when he reached him. He had never seen any bad effects from a bath before. He relied upon the electrical engineers for the condition of the apparatus. He had studied medical electricity for six years. The treatment was given under medical direction. The same standard of switchboard and other apparatus was in use in many places, and no accident had happened. The apparatus had been examined since. The lamp was used to show the quantity of current being made, and to check the quantity. If the lamp suddenly broke the full amount of current would pass uninterruptedly from the main, and would consequently be much larger. They had traced no defect in the bath since the accident. It was impossible from the position in which the deceased was found for him to have touched the switchboard.

Dr. Bernard H. Spilsbury, pathologist at St. Mary's Hospital and to the Home Office, said that the cause of death was nervous shock

and heart failure, due to the passing of an electric current. There was no danger in a man without medical qualifications administering the bath if he did so under medical direction.

E. H. Willis, of the Cavendish Electrical Co., said that the switchboard was out of the patient's reach. He could not see how the patient could have received an abnormal shock by the mere breaking of the lamp. This lamp was certainly broken, but whether it had short-circuited was another question. If the lamp was broken and not connecting, there would be no current in the bath, but if it had permanently short-circuited owing to the complete breaking of the filament, the current supplied to the bath would be largely increased. The only defect the witness could find in the bath was the non-protection of the water taps.

The Coroner: What is your opinion of the cause of the shock?—I have experimented with the bath. Supposing the lamp short-circuited—that is to say, the resistance was taken away—240 volts would pass through the bath. I have tried it myself, and found that a strong shock would be received. Another theory is that the filament of the lamp broke and attached again momentarily. Then, momentarily, a very large shock would be received.

Counsel suggested the desirability of having a number of small guide lamps, so that the danger of the whole current passing through would be obviated. The witness assented, and also agreed that some examining body to inspect apparatus would be desirable.

C. H. Smith, instructional engineer to the Marylebone Borough Council electric supply, said that the function of the guide lamp was to break down the voltage from 240 to about 15, or according to the requirements of the bath. The voltage in the bath would be increased by the breaking of the filament of the lamp and consequent short-circuiting. His theory was that a momentary short-circuit in the lamp had been caused. He had known such things to happen before. The high voltage would not be more than instantaneous.

The Midland Electrical Engineers' Ball.—The second Midland Electrical Engineers' annual ball is to be held at the Grand Hotel on Friday, December 20th. Mr. R. A. Chattock is the chairman of the Dance Committee. Mr. G. J. Birk, of 55, Newhall Street, Birmingham, is the hon. secretary and treasurer.

A Contemporary's Majority.—*The South African Mining Journal*, 125, Salisbury House, London, E.C. Special Twenty-first Anniversary Number. 3s. 6d.—We congratulate our contemporary upon its coming of age and the excellent issue with which it celebrates the event. An enormous amount of editorial matter is contributed by various authors relating to South African mining, engineering and other industrial affairs, and we believe that all having trade relations with that part of the world will find it worth while securing a copy of this very exhaustive production. The whole of the work was done locally in Johannesburg, but copies are obtainable in London.

The I.E.E. and "Submen."—The following letter arrived too late for our "Correspondence" columns:—

"I notice a letter from 'Subman' in the current issue of the Electrical Review, complaining bitterly of the attitude taken by the Institution of Electrical Engineers towards submen in general.

"Might I suggest that this is chiefly submen's own fault, and I think that if they were to put their pride in their pocket, and take up positions with some of the leading cinematograph companies, they would gain considerable advantage, not only in the matter of pay, but hours as well.

"One Who has Done so."

L.C.C. Stores Contracts.—Applications are invited from persons and firms wishing to have their names placed on the lists of those from whom the Council invites tenders for the supply of stores and the execution of maintenance contracts. See our advertisement pages to-day.

The Electro-Harmonic Society.—The concert arranged for Monday next will be a Ladies' Night, and, as usual, it will be held at the Holborn Restaurant (King's Hall), commencing at 8 o'clock. The preliminary programme announces the following artistes:—Vocalists: Miss Ada Forrest (soprano), Miss Amy Dewhurst (contralto), Mr. Alfred Heather (tenor), Mr. Peter Dawson (baritone). Pianoforte solo, Miss Marie Novello. Anglo-French comedian, Mr. Alec. Chentrens. Humoresques, Miss Olive Twain. Songs at the piano, Mr. T. C. Sterndale Bennett. Accompanist, Mr. Bernard Flanders, A.R.A.M. Mr. Duddell, the new President of the I.E.E., will occupy the chair.

October Trade Returns.—The official returns issued this week show that during the month of October imports increased by 17 per cent., exports by 10·9 per cent., and re-exports by 15·8 per cent., as compared with the corresponding month of 1911. The exports of electrical goods advanced by £250,563, and machinery increased by £537,435. For the ten months of the year the exports of electrical goods and apparatus (other than machinery and telegraph and telephone wire) have amounted to £3,745,349, an advance of £1,458,481; and those of machinery have been £27,502,255, an increase of £2,057,878.

Appointments Vacant.—Switchboard attendant, for the Corporation Electricity Department, Southend-on-Sea (30s.); second assistant to the Superintendent of Mains, Edinburgh Corporation Electricity Supply (£100). See our advertisement pages in this issue.

The Generators.—A dinner of the Generators will be held on November 22nd, and a concert will follow.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The result of the competitive examination held by the Caxton Publishing Co., Ltd., for business and commercial knowledge has just been published, and we are pleased to note that one of the Wimbledon Borough Council officials, Mr. W. J. Oswald, senior assistant engineer at the Corporation's Electricity Works, has secured fifth place. This is a creditable achievement, considering that there were over 500 competitors from all parts of the United Kingdom. He has been awarded a valuable set of books.

Mr. Percy Hickman, shift engineer at the Dewsbury Corporation Electricity Works, has resigned.

Mr. Charles E. Savage has resigned his appointment as borough electrical engineer to the Corporation of Dudley, in order to join the staff of the Earl of Dudley.

Tramway Officials.—The employés and staff of the Mexborough and Swinton tramways last week presented a silver cigarette case to Mr. C. W. Bentley, the assistant manager, who is leaving Rawmarsh to take up a similar position at Musselburgh, Scotland.

General.—The Council of the City and Guilds of London Institute has conferred the Fellowship of the Institute upon Mr. W. D. B. Duddell, F.R.S. This distinction is extended to those students who have obtained the Associateship of the Institute and spent at least five years in actual practice, and by original and valuable research work or otherwise have contributed to the advancement of the industry in which they are engaged.

York City Council has appointed Mr. T. R. Stancombe, of Dewsbury, as Superintendent of the Installation Department at the Electricity Works, at a commencing salary of £120 a year.

Mr. A. G. Warren, B.Sc., has been appointed a lecturer in the Engineering Faculty of the University of Hong Kong, under Prof. C. A. M. Smith, M.Sc. (late of the East London College). Mr. Warren was a lecturer in the East London College, and has been head of the Engineering Department of the Aston Manor Technical School, Birmingham, for the last 18 months.

According to the *City Press*, Mr. F. G. Whitaker, the Senior Superintendent of the London Postal Service, has just retired after 40 years' service. He joined the staff of the Electric Telegraph Co. in 1866, and four years later, on that undertaking being acquired by the Government, entered the service of the General Post Office.

The marriage took place at Melbourne (Derbyshire) on November 5th of Mr. John Thos. Hewes, of Allestree, chief electrician to Sir H. H. Raphael, M.P., and Miss Alice Heathcote, daughter of Mr. E. Heathcote, of Melbourne.

Mr. Robert Rankin, B.Sc., who, it will be remembered, read a paper on "Automatic Reversible Battery Boosters" before the I.E.E. last session, has joined the staff of the Electrical Power Storage Co., Ltd.

Last Saturday evening at the Connaught Rooms of the Trocadero Restaurant, a complimentary dinner was tendered to Mr. T. Stevens, M.I.C.E., by his past and present colleagues on the staff of the British Thomson-Houston Co., Ltd., upon his severing his connection with the company to enter consulting practice with Messrs. McCarter & Kerr Bock. A large contingent of the Rugby staff was present, as well as the staff from the London office. The chair was occupied by Mr. A. H. Walton, who, in a few well-chosen words, presented Mr. Stevens with an artistic souvenir as an expression of his colleagues' esteem, and voiced their regrets at the loss of his services to the company, wishing him success and prosperity in his new undertaking. All acquainted with Mr. Stevens's sterling ability and his unfailing courtesy feel certain that his success is assured. Following the toasts a much appreciated musical programme was supplied by the following artistes:—Miss Dora Clare, Mr. Murray Ashford, Mr. Norman Payne and Mr. Geo. Blackmore.

Obituary.—Lord Furness.—We deeply regret to record the death, which occurred on Sunday last, at the age of 60 years, of Lord Furness. In September, under medical advice, Lord Furness resigned the chairmanship of Palmer's Shipbuilding Co., and from that time onwards his health became worse. The story of his remarkable rise from humble circumstances (he was the seventh son of one who was at one time a coal-trimmer) to the peerage, and the commercial aptitude or instinct which lifted him stage by stage to affluence and great industrial influence, will doubtless be told in books for the boys for years to come, but the chief points in his career that justify reference to him here are his connection with the well-known firm of Richardsons, Westgarth & Co., Ltd., his experienced advocacy of greater enterprise being shown abroad by the British manufacturer, and his co-partnership scheme introduced in 1898 in the interests of industrial peace and efficiency, which scheme, as our readers know, was, after a short trial, unfortunately rejected by a small majority of the men, owing to Trade Union opposition.

The death is announced from Paris of M. Victor Popp, who for many years has been well known in the electrical world.

NEW COMPANIES REGISTERED.

Leitner (France), Ltd. (125,256).—This company was registered on November 8th, with a capital of £4,000 in £1 shares, to exercise and develop commercially in France certain patented inventions in connection with the Leitner system of automatic electric lighting for trains, tramcars, and other vehicles, and to adopt an agreement with the Leitner Electrical Co., Ltd. The subscribers (with one share each) are:—H. Leitner, 35, St. James' Place, S.W., electrical engineer; F. J. Collis, 7, Princes Street, Westminster, S.W., electrical engineer. Private company. The board is to include two directors, or a director and the secretary of the Leitner Electrical Co., Ltd. The first directors are H. Leitner, F. J. Collis, H. O. Duncan, and H. Munro. Registered office, 7, Princes Street, Westminster.

Blandford Forum and District Electric Supply Co., Ltd. (125,203).—This company was registered on November 6th, with a capital of £7,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. A. Hosker, Kirksleatham, Bournemouth, medical practitioner; E. S. Williams, Dean's Grove, Wimborne. Private company. The number of directors is not to be less than three or more than six; the first are W. H. Baxter, E. C. C. Smith, F. W. Reynolds, A. J. Woodroffe, J. A. Hosker, and E. S. Williams. Registered office, Moorgate Court, Moorgate Place, E.C.

Radio Signal Co., Ltd. (125,163).—This company was registered on November 4th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, electrical and mechanical engineers, manufacturers, installers and users of and dealers in electrical appliances, including signals and signal appliances, &c., and to adopt agreements (1) with W. H. Shephard and A. E. McKechnie, and (2) with T. H. B. Palmer and A. A. Sander. The subscribers (with one share each) are:—A. A. Sander, Thorpe Arnold, Warlingham, Surrey, tea broker; F. Evelyn Jones, Whyteleafe Grange, Whyteleafe, Surrey, solicitor. Private company. The number of directors is not to be less than two or more than seven; the first are F. Evelyn Jones, T. H. B. Palmer, A. A. Sander, W. H. Shephard and A. E. McKechnie. Registered office, Norfolk House, 7, Laurence Pountney Hill, E.C.

Hewson Manufacturing Co., Ltd. (125,253).—This company was registered on November 8th, with a capital of £1,000 in £1 shares, to take over the business carried on at 151-7, Wardour Street, W., as "Brown's Patent Syndicate," including the business of manufacturers of electrical and other fittings, illuminating and decorative signs and manufacturers to the electrical and kindred trades, and to adopt an agreement with another electrical company. The subscribers (with one share each) are:—T. Wood, 10, Delamere Terrace, Paddington, W., gentleman; G. F. Puckle, 26, Yale Court, West Hampstead, N.W. clerk. Private company. The first directors are H. Brown, F. Marpole and A. H. Brackensieck. Remuneration as fixed by the company. Registered by E. H. Riches, 85, Gracechurch Street, E.C.

Budleigh Salterton Electric Light and Power Co., Ltd. (125,155).—This company was registered on November 4th, with a capital of £7,000 in £1 shares, to carry on at Budleigh Salterton and elsewhere in Devon the business of an electric light company in all its branches, and to take over the rights and liabilities of J. A. Purves and W. T. Purves, of Exeter, in a provisional order in respect of the Urban District of Budleigh Salterton. The subscribers are:—H. W. Crews, 4-6, Rolle Street, Exmouth, auctioneer, 25 shares; C. T. K. Roberts, 10, Bedford Circus, Exeter, solicitor, 1 share; J. A. Purves, 11, Bedford Circus, Exeter, engineer, 1 share; J. Hartree, Green Gables, Budleigh Salterton, architect, 25 shares; G. E. Manisty, Naltore Lodge, Budleigh Salterton, architect, 25 shares; J. Row, 243 4, High Street, Exeter, ironmonger, 25 shares; A. A. Somerville, The Cliff, Budleigh Salterton, schoolmaster, 25 shares. Minimum cash subscription, £3,000. The number of directors is not to be less than four or more than nine; the first are H. W. Crews, J. Hartree, G. E. Manisty, J. Row and A. A. Somerville; qualification, £25; remuneration as fixed by the company. Registered office, 10, Bedford Circus, Exeter.

British Accumulator Co., Ltd. (125,172).—This company was registered on November 5th, with a capital of £13,900 in 4,000 "A" ordinary and 8,000 "B" ordinary shares of £1 each, and 38,000 deferred shares of 1s. each, to carry on the business of manufacturers of and dealers in accumulators and other bases for incandescent electric lamps, electric lamp fittings, batteries, dynamos, &c. The subscribers (with one "A" ordinary share each) are:—J. W. B. Peacock, Tanfield Buildings, Bradford, chartered accountant; F. M. Stephenson, 10, Carlton Place, Bradford, solicitor's managing clerk. Private company. The number of directors is not to be less than five or more than seven; the first are S. Willner, C. G. F. Walton, F. A. Gedge, F. W. Turner and G. H. Rayner; secretary, H. Birch; solicitor, H. Hammond, Bradford. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Egham and Staines Electricity Co., Ltd.—A memorandum of satisfaction in full, on October 30th, 1912, of debs. dated December 18th, 1911, and February 28th, 1912, securing £2,850, has been filed.

Brush Electrical Engineering Co., Ltd.—Particulars of £100,000 prior lien participating second deb. stock, created October 2nd, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £80,620. Property charged: Freehold and leasehold land, plant and machinery at Loughborough, and the company's other assets, present and future, including uncalled capital. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

Electrical and Engineering Supplies Co., Ltd.—Particulars of £600 debentures, created October 3rd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electrolytic Alkali Co.—The *Financier* states that this company, of Middlewich, intimated to the shareholders on Wednesday that the company was in negotiation for a scheme for the supply of power, which would represent a very large saving to the company. The scheme would probably involve certain rearrangements of the existing conditions; but it was expected that the negotiations would be completed at an early date, and that an announcement would be made at the annual meeting, which was being delayed.

Dorman, Long & Co., Ltd.—The directors have declared a final dividend of 5 per cent., less income-tax making, with the interim dividend, 7½ per cent. for the year.

Provincial Cinematograph Theatres, Ltd.—A second interim dividend of 5 per cent. has been declared, and was payable on November 4th.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

THE twenty-ninth ordinary general meeting was held on Thursday, November 7th, at Winchester House, E.C., Mr. Henry Wolfenden presiding.

In proposing the adoption of the report (see ELECTRICAL REVIEW, page 713), the CHAIRMAN said there were two salient features about it. One was that the profits had suffered a reduction when compared with the previous year, and, secondly, that the board did not recommend the payment of a dividend, though the profits could be held to justify such a payment if there had not been countervailing reasons. The reduction in the profits amounted to £6,333, and was mainly due to one item of expense being charged against revenue this year for the first time—he alluded to the payment of royalty under a licence which they acquired for the use of certain patents in connection with the manufacture of metal-filament lamps. If they had not had to debit the revenue with that item of expenditure the accounts would have shown profits much more nearly approaching those of last year, though they would still not quite have reached those figures. He was glad to say that the falling off was in no way due to a falling off in the turnover, which was in volume larger than in any previous year since he had been connected with the company. Raw materials had shown a constant tendency to advance in prices, and the various strikes which took place during the year did not make for economy. During the current year and in future they would have to bear the additional expenses of the Insurance Act. As to why they did not recommend a dividend, they could not both have their cake and eat it. Last year he spoke of two lines of extension—one dealing with their selling organisation in countries abroad and the other in extending their manufacturing facilities. The latter they had carried out, partially in the financial year under review and partially since the close of the year, and they were now well equipped with increased plant of the most modern type. They did not contemplate further expenditure of any material amount in this direction at present, though he did not wish to imply that they had arrived at finality. The outlook appeared promising. Their engineering works were full of orders, and were producing more largely than ever before. As to lamps, they were able to produce all types of that article now on the market, and in patterns more numerous and varied than any other individual lamp-making firm. The quality of their productions was unsurpassed. The extension in their foreign sales facilities was essential, and they expected to derive substantial benefit from the expenditure later on. They had taken steps to that end during the year, but much more remained to be done in that direction, and it was in that direction that their efforts must be directed for some time to come. That required money, and to provide it they had had to use their revenue for capital purposes. It was a platitude to say that a business could not stand still—it must either go forward or go back. They elected to go forward, and he believed the shareholders would continue that confidence in the board which they had hitherto shown. Meanwhile, the company was growing in strength, and they hoped as a result of their policy they might be able not only to earn dividends, which they were now doing, but also to resume payment of them as well as provide for the extension of the business. Proceeding to discuss the figures in the balance-sheet, the chairman said that the present position of the Altrincham Electric Supply Co. was a very satisfactory one. Stock and plant which figured at £267,341, was divided as to stock, £186,639, and plant, £80,702. The stock showed an increase of £5,000 over the previous year. That increase and more was caused by the larger stock of raw materials and work in progress. Their lamp stocks were reduced by about £5,000. Plant was up £1,543. A new item in the accounts was expenditure on foreign branches, trade marks and experimental account, £4,450. During the year they had taken steps to establish themselves in two countries abroad. From one of those countries they were regularly receiving orders in consequence, but he regretted to say that so far the results from the other country had not been satisfactory, owing to difficulties in connection with starting the business. As to trade marks, they found that in several countries which they considered important to them, their trade marks were not registered. They had now corrected the omission at a cost of about £500. The expenditure on experimental account spoke for itself, and he could only say that they had obtained valuable results from it. The total expenditure under those three heads was £4,450, and although it had been necessary for the proper carrying on of the business, they could not say that it was represented by tangible assets. On the other hand, it was for the permanent benefit of the company, and they had decided to debit the present year's account with half of the amount, carrying forward the balance to a suspense account. The final result was that they proposed to add £10,000 to the reserve fund, bringing it up to £45,000, and increasing the carry forward by £446.

MR. E. B. ELLICE-CLARK seconded the motion.

MR. PARSONS asked what the London expenses and the directors' fees amounted to. He also inquired whether the additional £5,000 which the company had invested in the Altrincham Co. was compulsory.

MR. RAYMENT complained of the delay in getting out the accounts, and moved as an amendment that instead of carrying £10,000 to the reserve fund, a dividend of 1¼ per cent. should be paid, and the balance remaining carried forward.

MR. KILLINGWORTH HEDGES, as an original shareholder, criticised the management for their want of "push," and said there

seemed to be a sort of dry rot going on, as the company did not move with the times. At first they had an excellent business, but when the metal-filament lamp came in they neglected their opportunity, and stuck to the old carbon lamp.

The CHAIRMAN, in reply, said that Mr. Rayment's amendment was out of order. Shareholders had power to reduce the dividend, but not to increase it. With regard to the carbon lamp, it was still being made by themselves and others almost to the same extent as it was years ago, and he did not see why they should give up a valuable trade, especially as it in no way detracted from the amount of business they did in metal-filament lamps. If they had been in the possession of funds when metal-filament lamps came out, they would have been able to purchase the patents, but that was not possible, as they had not got the money. If they took stock of the position to-day, and compared it with the position in 1901, when a change in the directorate took place, he had no hesitation in saying that it had immensely improved. As to the directors' fees, they were £3,000, and he, as chairman, received the lion's share, as he devoted practically the whole of his time to the business of the company.

The report was then adopted.

Stock Exchange Notices.—The Committee has (1) appointed special settling days, as under :—

Wednesday, November 27th.—Brisbane Electric Tramways Investment Co., Ltd.—Further issue of 15,000 ordinary shares of £5 each, fully paid, Nos. 75,001 to 90,000.

And ordered the undermentioned securities to be quoted in the Official List :—

Bombay Electric Supply and Tramways Co., Ltd.—60,000 ordinary shares of £10 each, fully paid, Nos. 1 to 14 and 60,001 to 119,986.

Brisbane Electric Tramways Investment Co., Ltd.—Further issue of 15,000 ordinary shares of £5 each, fully paid, Nos. 75,001 to 90,000.

London Electric Supply Corporation, Ltd.—Further issue of £86,667 4 per cent. first mortgage debenture stock.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to : —

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 130,000 preference shares of £1 each, fully paid, Nos. 1,708,001 to 1,838,000.

And to allow the following securities to be quoted in the Official List :—

Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000. Renewed special application.

Fraser & Chalmers, Ltd.—The directors report that the accounts for the year ended June 30th show a net profit of £7,378, after payment of debenture interest and after making the usual provision for depreciation, to which must be added £84,132, being the credit balance brought forward, making a total of £91,511 to the credit of profit and loss account. Out of this sum the directors have paid the full preference dividend for the year of £4,725 and an interim ordinary dividend of 3 per cent., absorbing £11,340, leaving a balance of £75,446 to be carried forward. The directors regret the serious decrease in the net profits of the undertaking for the period covered by the accounts, as compared with the year ending June 30th, 1911, which showed a profit of £31,892. According to a financial paper, this difference is due to a decrease in the sales of mining machinery both in South Africa and in England, to severe competition with its inevitable reduction in the selling price of the company's products, and to the necessity of incurring heavy preliminary and other expenditure in the manufacture and introduction of other lines of machinery now called for by users both at home and abroad. To meet this demand and keep the company abreast of the times, the directors have secured valuable patent and manufacturing rights for new types of machinery, and they anticipate that the outlay involved in their introduction will add to the profits of the undertaking in the near future. Owing to the reduced profits, the directors do not recommend the payment of any further dividend for the year.

Castner-Kellner Alkali Co., Ltd. — The directors report that the net profit for the year to September 30th, after allowing for the amount expended in keeping up the works, plant and machinery to the highest state of efficiency, is £177,062, plus £13,222 brought forward, making £190,285. After deducting debenture interest £8,682, and interim dividend of 7½ per cent. paid May 29th, £33,750, there is an available balance of £147,852. The directors recommend the appropriation of this balance as follows : £32,500 to depreciation reserve, increasing it to £322,500 ; £47,500 to the general reserve, increasing it to £177,500 ; £56,250 in payment of a final dividend of 12½ per cent., making (with the interim dividend paid in May) 20 per cent. for the year, leaving £11,602 to be carried forward.

Provincial Tramways Co., Ltd. — The directors' report states (says the *Financier*) that the revenue account for the year to September 30th shows that the net revenue received from the local companies was £36,051 plus £3,354 brought forward. After paying debenture interest, preference dividend, and interim ordinary dividend there remained £18,877. The directors have set aside to credit of reserve and depreciation account £10,000 and written off £500 from the expenses of the issue of debenture stock, leaving a balance of £8,377. The directors recommend that a dividend be paid upon the £1 ordinary shares of 10d. per share, making with 8d. per share paid in June last 1s. 6d. per share, a dividend of 7½ per cent. per annum for the year. The balance dividend upon the ordinary shares will absorb £5,190, and leave £3,187 to be carried forward. The balance standing to the debit of "Expenses of issuing debenture stock" is £2,500, and the directors have written this balance off the reserve and depreciation account, thus extinguishing the debit.

Eastern Telegraph Co., Ltd.

THE meeting of the company was held on Wednesday, at Electra House, E.C., Sir J. Wolfe Barry presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 756), said that the gross revenue for the period under review had exceeded that of any previous half-year, while the improvement shown continued to be well maintained. The gross revenue amounted, in round numbers, to £746,700, as against, for the corresponding half-year of 1911, £672,400, or an increase of £74,300. Message receipts showed an increase of £66,500, the increase being spread over practically every branch of the system. It was satisfactory to find that the growth of revenue was due to a general improvement in commercial business, and was not attributable to any of those events of special importance which might, for the time being, affect one particular section of traffic, although, no doubt, the war in Tripoli, while it lasted, to some extent contributed towards the improvement of the revenue. The introduction of deferred messages had also created a new source of revenue while not adversely affecting the ordinary fully-paid traffic ; but, so far, these messages had not materially affected the total revenue. Dividends on shares in other telegraph companies had produced £3,100 more than for the corresponding half-year of 1911, while interest on reserve fund investments and on cash on deposit at the bank, &c., accounted for the remainder of the increased revenue. As regarded the expenditure the total ordinary working expenses amounted, in round numbers, to £306,000, as compared with £291,300 for the corresponding half-year of 1911, or an increase of £14,700. As he pointed out at the last meeting, the growth in volume of traffic necessarily entailed more labour and naturally tended to generally increased expenditure under practically all headings. The expenses in London showed an increase when comparing the two half-years of £1,700, due to some additional staff, but principally to the usual annual promotions. The expenses as stations were £26,700 more than they were in the half-year to June, 1911. Salaries and wages alone were £14,600 more, due to a considerable augmentation in the number of the staff, and to the improved conditions introduced with regard to overtime and Sunday duty. Maintenance of instruments showed an increase of £3,600, caused by the introduction of new apparatus for improving the working of the cables and landlines. Against the increased expenditure the expenses attending maintenance of cables showed a reduction of £14,000 when comparing the two half-years. The board had considered it advisable, in view of the continued depreciation in the market value of the reserve fund investments, to increase the provision on account of investment fluctuations, and had accordingly transferred a further sum of £50,000 from the general reserve fund, for that purpose, the amount set aside on this account now standing at £300,000. As years went on the directors became more impressed with the importance of maintaining a large reserve fund, convinced as they were that the stability of the company was in no small measure due to the consistent carrying out of the policy of maintaining large and available reserve funds. Since 1910 they had expended over £100,000 on various sections, which sum had been charged from time to time against the reserve fund, and they were continuing the work as opportunity offered. They had also charged the cost of the new Gibraltar-Malta-Alexandria cables against this fund, the last instalment of over £220,000 appearing this half-year. The increasing volume of business on the cables, which was proportionately greater than the increase of net revenue, pointed to the necessity of strengthening their cable capacity east of Suez, and the directors had in view the laying of new and important cables from that station eastward, so soon as the necessary landing rights were granted. The Eastern Extension Co. also proposed at the same time to strengthen their means of communication in the Far East. Those new cables would, of course, involve considerable expenditure, which would be met out of the reserve fund and out of the normal increase of revenue. It must be a source of gratification that their reserves enabled them to deal with those matters without any anxiety regarding the usual dividends and bonus paid to the stockholders and without increasing the capital. In view of the foregoing, it was fortunate that they had been able to carry the sum of £230,000 to general reserve fund this half-year. With the view of giving the public a cheap social telegraph service with South Africa, they had introduced week-end letter telegrams between the United Kingdom and the Union of South Africa, and the system came into operation last week. The messages must be written in plain connected English or Dutch language, and the tariff was 15s. for the first 30 words, with an additional 2s. 6d. for every five words or less beyond that number. Messages could be handed in on any day of the week, and would be sent off on Saturday evening. If they were addressed to a town at which the company had a station, the messages would be delivered on Tuesday morning ; if intended for other places they would be posted on, but, if desired by the sender, could be telegraphed to their destination upon payment of the respective local interior telegraph rates for Great Britain or the Union of South Africa.

SIR J. DENISON-PENDER seconded the motion, and the report was adopted without discussion.

Continental.—GERMANY.—The Rhenisch Westfälische Electricitätswerke Gesellschaft, of Essen, reports a gross profit of £391,429 for the last financial year, as compared with £384,840 in the preceding 12 months. The net profit amounts to £169,042, which enables the dividend of 8 per cent. to be maintained.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The half-yearly meeting was held on Tuesday at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 756), congratulated the shareholders upon a satisfactory half-year. The gross receipts had amounted to £367,000, against £329,000 for the corresponding period of 1911, an increase of £38,000. This satisfactory result was due to a growth of commercial traffic all over the company's system, and it was gratifying to find that this growth had continued since the close of the half-year. The expenses during the same period amounted to £166,000 against £151,000, showing an increase of £15,000, of which nearly £12.000 was accounted for by the heavier cable repairs carried out during the past half-year than in the corresponding period of 1911, and to debiting revenue with the cost of relay and other improved apparatus. The remainder of the increase was due to increased staff, salaries, and other incidental charges. The net profit for the half-year was roundly £182,000, and, after adding £23,000 brought forward, there remained an available balance of £206,000. The usual quarterly interm dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, and after making the usual provision out of revenue for the maintenance ships, insurance and depreciation funds, and adding £75,000 to the general reserve fund, the balance carried forward amounted to £56,000, or, roundly, £5,000 more than for the same period of 1911. In view of the increase in the volume of traffic between Europe and the company's system east of India, and also in their local traffics, due to commercial activity, and the continuous policy of the company, to which he had frequently referred, of lowering their tariffs when they were able to do so without injustice to their shareholders, the directors had in contemplation the strengthening of their cable capacity in the Far East. The Eastern Telegraph Co. had also under consideration important cable improvements west of India. The two proposals would thus form a strengthening of the companies' communication, but, of course, they would be expensive. Owing, however, to the existence of their reserve funds, and the growth of their traffic, they could contemplate the necessary expenditure, which would occupy some two years or more, without any interference with the stability of their ordinary dividend and bonus. As announced in the report, the vacancy in the directorate occasioned by the death of the Marquis of Tweeddale, had been filled by the appointment of Lord Inchcape.

Mr. F. A. Bevan seconded the motion.

Replying to shareholders, the Chairman said the reserve fund investments stood in the books at cost price. The board, with the approval of the shareholders, had arrived at the conclusion that there should be some allowance made for depreciation, and they had put aside a round sum of £150,000 for that purpose. With regard to wireless telegraphy, he saw no reason to alter anything he had said before on the subject, and the experience they had had of its working, and of the considerable strides it was making in different directions, had been that it had done their traffics no harm whatever. How far the increased development of putting up Government stations would be in competition with them it was impossible to say. He did not think they need fear the competition so long as the cables could give a rapid and trustworthy mode of telegraphic communication free from all tampering or tapping. With a certainty of good service he believed the cable companies would always hold their own. As he had said many years ago, if the order of invention had been reversed, and wireless telegraphy had come first and cable telegraphy second, he believed the world would have said—What an enormous improvement the cable method of transmitting telegraphic messages is. As long as they could hold their own as giving the best service to the public, and at a moderate cost, personally he did not think they need fear the competition of wireless telegraphy.

The report was adopted.

Western Telegraph Co., Ltd.

The directors report that for the half-year ended June 30th, 1912, the revenue amounted to £450,815, and the working expenses to £169,770. After providing £16,373 for debenture stock interest, and £8,294 for income-tax, there remains a balance of £256,377; to this is added the sum of £30,312 brought forward from December 31st last, making a total of £286,689. A quarterly interim dividend, amounting to £31,189, has been paid, £445,000 transferred to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £15,000 to the provision on account of investment fluctuations. The directors now recommend the declaration of a final dividend of 3s. per share, making with the interim dividends a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving a balance of £33,517 to be carried forward. The dividend and bonus will be payable on November 14th.

Sir J. Wolfe Barry, K.C.B., presided on Wednesday over the meeting of this company held at Electra House, E.C.

In proposing the adoption of the report (see above), the Chairman said that during the period under review there had been considerable expansion in the volume of trade and commerce in all the countries of South America which were served by the company's system, and they hoped this would be maintained in the future. The company had assisted in the development of these countries by affording a speedy trustworthy means of communication between all parts of that great continent and the other markets of the world. A reduction of 1 fr. per word in their tariff for telegrams was made in May last, and they trusted the telegraphic traffic would increase to such an extent that they would not suffer financially in consequence of this large reduction of nearly 35 per cent. Indeed, the figures to date seemed to warrant this hope, but when development took place so rapidly it was occasionally followed by a period of reaction, and they must not count upon the increases which they had lately had, being maintained without some check. The receipts from messages and other sources of revenue for the half-year showed an increase of nearly £46,000. With regard to the expenses, those in London were more by £362, and at the stations abroad were increased by £8,577. The principal items to which this increase was due were salaries and wages of additional staff required to deal with the increased traffic and the usual annual promotions and increments to the employés of longer service; rent and house allowances were also more at two or three stations. Other accounts which caused extra expenditure were: repairs and additions to buildings and furniture, bankers' commission and legal expenses. On the other hand, there was a decrease in stationery and printing, but this is due to an exceptionally large supply having been sent out last year. The other accounts included in the total of £125,000 showed a net increase of £2,661, which was explained by the further cost of new landlines at Pernambuco and Santos. The several increases to which he had alluded amounted to £11,600. On the other hand, the expenses attending the maintenance of cables were less by £6,639, and there was no item corresponding to that in 1911, when a bonus was granted to the staff.

Sir J. Denison Pender seconded the motion.

Mr. Humphreys said that reading the report of a cable company's meeting recently, he noticed that they had established wireless telegraphy between two of their smaller stations. It seemed to him that this was a new development, and one likely to be a useful auxiliary to their service. He would like to know whether the board contemplated the adoption of that system under similar circumstances in connection with any other stations.

The Chairman, in reply, said that at the present time the Western Co. had not in contemplation any particular station for wireless telegraphy, but the associated companies—in particular the Eastern Extension and the Eastern—had either instituted already, or were contemplating, exactly what Mr. Humphreys had in his mind—that was having a wireless system with a moderate amount of power in direct communication with their cable stations. That had been found extremely useful in several cases for passing ships. Up to the present time the associated companies had recognised that wireless telegraphy might be a useful feeder to the cables, and that had been borne out by their experience up to the present time.

The report was adopted.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The accounts for the year ended June 30th show gross receipts amounting to $5,465,300, from which must be deducted operating expenses and taxes $2,642,900, leaving net earnings $2,822,400. Interest on the funded debt has absorbed $1,417,300, the dividend on the 6 per cent. preference stock takes $381,600, while the dividend on the common stock has been raised from 4½ to 5 per cent. There has been set aside for renewals and amortisation, &c., $455,500, leaving a surplus for the year of $204,900.—*Financier.*

Prospectus.—*Ferranti, Ltd.*—The directors have issued to debenture stockholders and shareholders forms of application for an issue of 6 per cent. five-year notes, to the amount of £50,000 in registered notes of £100 each at 95 per cent., which was authorised at the recent meeting.

STOCKS AND SHARES.

Tuesday Evening.

Domestic, as well as foreign, politics have been playing their parts in Stock Exchange markets this week. A difficult account has had to be arranged, the *débâcle* of the end of October being succeeded by further falls in many of the other departments of the House, while various alarms and excursions from the Near East contributed their quota to the causes for unrest. There are indications, however, that the public begin to realise the comparative cheapness of many stocks and shares which cannot be affected, except indirectly, by the Balkans difficulties. People have had to sell investments in order to pay differences; and dealers, while not averse to having stock on their books, naturally wanted to get it as cheaply as possible. The remarkable strength of Consols, however, is a bull point for the House at large; and the mere anticipation of a change of Government at home provided an added cause for subdued cheerfulness.

The feature of the Home markets, so far as Electricity is concerned, is a boomlet in Central London issues. The Ordinary stock put on 5 points on Monday afternoon and 6 more on Tuesday, the Deferred following with a gain of 8. Inquiries in the market as

to the cause of this sudden improvement were met with the polite reply that the company was going to be taken over, beyond which the informants would no farther go. "What does it matter," said they, "who is the lucky purchaser? Surely it is sufficient to be told that the line is going to be bought up?"

City and South London rallied to 42¼, after having been weak, the price going back to 40½, notwithstanding persistent tips that it was the cheapest to buy in the Home Railway market. The company's 1903 Preference has risen 1, which brings it into line with the 1891 stock. Metropolitans, from 55¼, tumbled to 52½, at which price support was accorded and a smart recovery marked. Districts are unaltered on the week, and no change has taken place in Great Northern and City Preferred. Underground Electrics went back slightly—the 1s. shares to 12s.

News is still awaited as to developments in the case of the Metropolitan Electric Tramways Company, pending which the price of the Ordinary hardened to 1 5/16, and the Deferred to 6s. 3d., though both Debenture stocks of the company lost a point apiece. London United Tramways Preference are another House tip, and show ⅛ rise, but whether it is right or not to buy them should be, it seems to us, left to the judgment of those with inside knowledge. Some announcement is expected this week. British Electric Traction Preferred went back to 12.

In the Foreign department, the Mexican group shows a fair amount of steadiness, and this notwithstanding the fact that some of the other securities connected with the group to which these Latin-Canadians belong, have been the reverse of good. Mexican Light and Power, and Mexico Trams are unchanged. Monterey Debenture eased off ½, and Shawinigan Water fell 1. On the other hand, Sao Paulo Trams regained 5 points, and Montreals are 4 up. A good deal of business is being done in the rights on Mexico Trams, the price of which at the time of writing is about 1½ premium, bargains being done for cash. This price, it may be mentioned, is quoted for the rights on the old shares. For example: a seller of the new shares which attach to 50 Mexico Tramways would receive £15 if he sold at 1½ premium.

Anglo-Argentine Tramways Preferences are a dull market, and the Firsts can be picked up below 5. There is, however, a better feeling for the Debenture stock, and the latest issue hardened from 2½ discount to 1½ discount, while the 4 per cent. Debenture stock put on ½. British Columbia issues are better, and Electric Supply of Victoria Debentures are 2 points to the good. Calcuttas eased off ⅛, and La Plata Trams are flat as the result of the recent meeting. At that gathering we believe there was sharp criticism; but so far as we have been able to ascertain, those proprietors who were not present at the meeting received no further intimation of this, beyond the statement that there was some discussion. On this point there may be more to say later.

The telegraph market is firmer, and the recent reports by the Eastern undertakings are regarded as extremely satisfactory. Eastern Ordinary is a point to the good, but Eastern Extensions have not recovered the small amount which they lost last week. Globe Preference gave way on a few forced sales, and West India and Panama dwindled to 3 3/16. In the American section, Anglo-American Deferred rallied to 25¾, but there is not much change otherwise. Amazons at 8 show an improvement. Indo-Europeans again gave way, and Great Northerns lost 10s. National Telephone Deferred hardened on balance, although there are occasional spasms of weakness. Oriental Telephones are 3/32 lower.

The market in Marconis is moved by the speculative position, and after the shares had been sold down to 5, they picked up to 5⅛. Activity developed in Canadian Marconis, the announcement that the Canadian Government had come to terms with the company helping to stimulate business. After hardening to 22s., the price drooped to 20s. 6d., while Americans and Spanish are almost neglected.

Amongst English Electricity Supply shares, Metropolitans continue to be a weak market, falling another ⅛; while County Preference lost ¼. On the other hand, Hoves have moved up to 7¾, and the demand for them appears to be still unsatisfied. The market as a whole is extremely quiet, and even in City Lights dealings have died away to something like a minimum. At the same time, the holder of any of the London companies' shares may be well advised not to sell just at present.

Manufacturing stocks and shares are somewhat on the dull side. Electric Constructions are certainly harder, and Callenders regained 5s. of the recently-deducted dividend. India-Rubbers, however, fell 10s. to 11. Castner-Kellners are a little lower, despite the repetition of the 20 per cent. dividend, and Brush Second Debenture was marked down another 2 points. The Rubber market failed to benefit from a slight stiffening of the quotation for the raw produce, share prices remaining dull on the whole.

Hurst, Nelson & Co., Ltd.—The annual meeting was held at Glasgow last week. According to the *Financier*, Sir Thomas Mason, who presided, said he was glad to be able to recommend a dividend. Their prospects were entirely different from last year, and but for the miners' strike the conditions would have been even better. They were in the position to be able to pay 12 months' dividend, and a dividend at the rate of 6 per cent. per annum on the preferred share capital from May 15th to November 11th was payable on the latter date, while a dividend of equal amount would be paid on May 15th next. Railways had been giving the company a good share of work. Orders were coming rapidly in from both England and Wales. If prospects continued as they were, the condition of the company would be even better next year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Nov. 6	2,845	+ 179	23	36,300	+ 319	14·4	..
Ayr	„ 9	292	+ 14	25	9,916	+ 238	8	..
Birmingham Corp.	„ 2	21,745	+4,909	31	330,674	+101.738	57·17	..
Blackburn	„ 6	2,289	+ 164	32½	39,060	+ 624	14·62	..
Blackpool Corp.	„ 7	1,176	+ 90	..	60,875	+ 5,690	11·87	..
Blackpool-Fleetw'd	„ 9	600	+ 54	18	24,536	— 520	8	..
Bournemouth	„ 6	3,187	+ 103	31⅔	64,469	+ 1,874	21·95	..
Bradford	„ 4	10,518	+ 69	31	174,488	— 691	56	..
Brighton	„ 10	1,719	+ 34	32	85,987	— 1,035	9·5	..
Bristol	„ 8	13,560	+1,105	..	311,132	+25,430	80·5	..
Brit. Elec. Trac. Co.								
‡Airdrie	„ 1	582	+ 43	44	13,182	+ 3,363	3·65	..
Barnsley	„ 1	586	+ 9	„	7,928	— 288	..	..
Barrow	„ 1	664	+ 64	„	16,864	+ 3,181	5·37	..
Devonport	„ 1	1,050	+ 47	„	23,724	+ 1,649	8·85	..
Gateshead	„ 1	2,159	+ 2	„	46,964	+ 11	11·25	..
Gravesend	„ 1	433	+ 23	„	9,318	— 153	6·5	..
Greenock	„ 1	1,543	+ 134	„	35,813	+ 3,683	7·25	..
Kidderminster	„ 1	205	+ 11	„	5,530	+ 86	..	..
Merthyr	„ 1	402	+ 6	„	8,874	— 376	2·9	..
Metropolitan	„ 1	16,965	— 139	„	387,177	— 1,409	22	..
Middleton	„ 1	421	+ 12	„	14,823	— 337	3·5	..
Mid. Joint Com'tee	„ 1	6,691	+ 412	„	140,763	+ 7,468	..	..
Oldham—Ashton	„ 1	1,201	+ 55	„	26,968	+ 1,682	9·18	..
Peterborough	„ 1	245	+ 5	„	6,183	+ 341	5·81	..
Potteries	„ 1	4,815	+ 77	„	84,479	— 1,446	29	..
Rothesay	„ 1	99	+ 18	„	10,353	+ 471	2·75	..
Southport	„ 1	514	+ 14	„	13,398	— 252	8·17	..
S. Metropolitan	„ 1	1,558	+ 13	„	37,544	— 916	..	..
Swansea	„ 1	2,280	— 15	„	50,876	+ 190	12·5	..
Tynemouth	„ 1	295	— 5	„	11,024	— 941	3·75	..
Weston-s-Mare	„ 1	67	— 2	„	6,726	— 1,300	3	..
‡Worcester	„ 1	551	+ 10	„	13,129	— 67	5·75	..
Wrexham	„ 1	217	+ 11	„	5,682	+ 570	..	..
Yorks. Wool. Dist.	„ 1	2,147	+ 17	„	47,783	+ 1,140	17	..
Miscellaneous	„ 1	417	+ 9	„	10,262	+ 182	..	..
Burnley	„ 9	3,045	+ 345	..	..	..	12·44	·7
Burton-on-Trent	„ 10	521	— 10	32	8,793	— 480	6·6	..
Bury	„ 10	2,525	+ 178	32	42,197	— 197	22·5	..
Cardiff	„ 2	4,883	+ 274	31	76,511	— 1,857	17·25	..
Chatham and Dist.	„ 7	1,650	— 14	45	38,723	+ 61	14·9	..
Cork	„ 7	983	+ 20	45	21,756	— 928	9·89	..
Croydon	Oct. 25	3,477	+ 19	30	55,191	+ 929	11·6	..
Darlington	Nov. 2	460	+ 9	31	7,00	+ 71	4·87	..
Darwen	„ 8	560	+ 41	32	9,021	+ 261	4·36	..
Dover	„ 2	425	— 1	31	8,121	— 576	4·75	..
Dublin	„ 8	10,407	+ 567	..	111,519	— 8,542	54·22	..
East Ham	„ 9	2,121	+ 15	32	34,503	— 878	7·87	..
Glasgow	„ 9	38,852	+ 273	..	485,823	— 9,905	98	..
Hastings	„ 11	1,572	— 78	..	..	— 2,428	19·8	..
Hull	„ 9	6,036	+ 20	32	94 866	+ 1,142	13·5	—1
Ilkeston	„ 7	224	— 19	32	3,611	— 718	..	..
Ipswich	„ 2	773	+ 16	31	14,516	— 209	10·5	..
Kilmarnock	„ 2	3 5	+ 11	24	4,081	— 180	4·2	..
Lancashire United	„ 6	2,638	+ 51	45	60,775	+ 17	39	..
Leeds	„ 9	15,694	+1,079	32	251.343	+ 8,318	112·5	..
Leicester	„ 9	5,144	+ 265	4	114,9 7	+ 3,660	20	..
Leith	„ 9	1,220	+ 56	253	17,775	+ 408	3·724	..
Liverpool	„ 2	23,824	+ 801	43⅔	526,137	+22,277	119	3
‡L.C.C.	Oct. 30	82,980	—3,890	..	1,284,637	—63,854	141·1	—1
London United	Nov. 9	11,172	— 169	..	282,797	—13,632	..	..
Lowestoft	„ 9	353	— 11	5	1, 57	— 80	3·5	..
Manchester	„ 9	33,882	+2,138	32	540,168	+18,351	105	..
Newcastle	„ 9	9.009	+ 508	..	141 305	+ 2,273	31·3	..
†Newport	„ 2	705	+ 24	31	22,029	— 463	7·25	..
Oldham	„ 10	4,088	+ 205	33	68,411	+ 3,732	23	..
Pontypridd	„ 2	830	— 5	31	12,326	— 655	5·5	..
Preston	„ 6	1,573	+ 53	32	26,824	+ 1,190	10	..
Rotherham	„ 6	1,843	+ 354	31⅔	24,029	+ 2,256	18	6
Salford	„ 11	9 801	+ 415	32½	162,.33	+ 3,769	41	..
Sheffield	„ 12	18,941	+ 938	..	220,303	+ 9,004	40	..
Southampton	„ 6	2 269	— 24	31	40,557	— 128	11	..
Southend-on-Sea	„ 6	1,138	+ 119	32	27,472	+ 2,782	7	..
South Shields	„ 9	1,232	+ 77	33	20,639	+ 215	10·25	..
Tyneside	„ 6	907	+ 49	19	9,439	— 641	11	..
Wallasey	„ 9	2,062	+ 102	31⅔	36,504	— 352	8·72	..
†Walthamstow	„ 9	665	+ 33	32	23,993	— 1,015	9	..
West Ham	Oct. 31	5,103	— 246	30⅔	81,1·0	— 3,233	16·45	1·2
Wolverhampton	Nov. 6	2,004	+ 102	32	32,652	+ 784	13·75	..
Cen. London Rly.	„ 9	10,998	+ 367	19	90,305	+ 2,404	6·78	·5
City & S. Lon. Rly.	„ 10	6,155	— 615	19	55 391	— 4,391	7·26	..
Dublin-Lucan Rly.	„ 1	248	+ 5	18	2,813	— 102	7	..
G.N. and City Rly.	„ 9	3,069	— 96	19	26,477	— 202	3·5	..
L'pool Overh'd Rly.	„ 10	3,196	+ 350	..	31,411	+ 2,295	6·6	..
Llandudno-Col. Bay	„ 1	340	+ 47	48½	15,596	+ 735	6·5	..
Lond. Elec. Ry. Co.	„ 9	22,480	—1,580	..	242 940	+ 4,580	21·25	..
Mersey Railway	„ 9	4,651	+ 502	19	40.302	+ 4,277	4·5	..
Metropolitan Rly.	„ 3	84 217	— 121	18	302,985	+ 6,009	24·75	..
Met. District Rly.	„ 9	26,788	+ 751	..	234,236	+19 050	25	..
Anglo-Argentine	„ 4	105,717	+9,927	..	2,245,981	+100,039	..	..
§Auckland	Oct.	19,071	- 2,586	4	78,029	+13 172	24·1	·8
Bombay (B.E.T.)	Oct. 11	6,406	— 60	41	126,128	+ 5,746	..	..
§Brisbane	Sept.	22,700	+1,660	9	181,094	— 3,566	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 11	7,662	— 335	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	3,251	..	9	28,788	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Oct. 31	1,607	+ 101	..	33 241	+ 8,601	14·7	2
§Montevideo	Oct.	28,488	+3,454	12	346,306	+47,753	..	..
Perth (W.A.)	Nov. 8	3,764	+ 511	..	83,993	+11,896	99	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9⅛ — 10⅛	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10⅜	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8¾ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4¼ — 4⅜	..	5 5 3
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 8
County of London, Ord.	10	6	4†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11⅜ — 12⅝	— ¼	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101 xd	..	4 8 3
Edmundson's, Ord.	5	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7⅞ — 8	+ ⅛	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1⅝ — 2⅛	..	3 10 8
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅜ — 3⅞	— ⅛	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97¼ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ —101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9¼ — 10¼	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜ — 1⅝	..	..
South London, Ord.	4	5	..	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅜	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	£3	Nil	..	¼ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅛ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8⅜ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅝	— ⅛	5 6 8
Calcutta, Ord.	5	8½	..	6⅝ — 7⅛	— ⅛	5 15 3
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	+ ⅛	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 9
Canadian Gen. El. Com.	$100	7	7	116 —120	—2	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	85 — 88	+2	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	1/2 — 11/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 18 8
Mexican Lt. & Power, Common	$100	4	4†	84 — 87	..	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105	..	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83 — 86	— ½	5 16 3
Montreal, Lt., H. and Power	$100	8	9†	234 —239 xd	+ 3	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39 — 42 xd	..	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111 xd	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	139 —143	—1	3 9 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref.	1	11 7/16d.	17 7/16d.	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7⅞ — 8⅛	+ ⅛	4 17 0
Do. 5 % Deb. Red.	Stock	5	5	96⅝ — 98⅝	+ ⅛	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	145⅛ —147⅛	..	5 8 6
Do. Collat. Trust	$1000	4	4	93⅜ — 95⅜	..	4 3 9
Anglo-American Telegraph	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110¼ —111¼	— ¼	5 6 8
Do. Def.	Do.	80/-	..	25/8 — 2 13/16	+ 1/16	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅜ — 7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	..	9 1/16 — 10⅛	— ⅛	5 17 1
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7⅛	..	6 18 0
Direct United States Cable	10	5	4	7⅛ — 7⅜ xd	..	6 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	+1	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	76½ — 78½	— ½	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98 xd	..	4 1 8
Eastern Extension	10	7	7†	12⅝ — 13⅜	..	5 6 8
Do. 4 % Deb.	Stock	4	4	97 — 99	—2	4 0 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101 xd	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ — 11⅛	..	5 7 7
Do. 6 % Pref.	10	6	6	12 — 13	— ⅛	4 12 4
Great Northern Telegraph	10	18	18	27 — 29	— ⅛	6 4 2
Indo-European Telegraph	25	13	5†	53 — 58 xd	— ⅛	6 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 — 5⅛	— 1/16	3 18 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅛ — 4⅜	— ⅛	3 15 7
Monte Video Telephone, Ord.	1	6	5†	1 5/16 — 1 7/16 xd	..	5 13 0
Do. 5 % Pref.	1	5	5	1/2 — 1/4 xd	..	5 14 3
National Telephone Def.	Stock	6	..	153 —155	+ ⅛	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 98 xd	+ ¼	4 10 11
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1⅝ xd	— 1/32	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16 xd	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10¾ — 11⅜	..	8 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼ — 7⅜	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 31/32 — 1 15/16	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Brzs. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3 1/16 — 3 5/16	— 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 11⅛	..	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅝ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13¾ — 13⅞	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	— ½	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 - 101	..	4 9 1

* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 12th.	Rise + or Fall —	Present Yield £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	— ⅛	..
Do. Do. Deferred	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	36 — 39	..	..
Do. 5 % Perp. Deb.	100	5	5	90 — 94	..	5 11 1
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81 xd	..	5 7 2
Central London Railway, Ord.	100	8	8†	84 — 86	+11	8 9 9
Do. Pref.	100	4	4	84 — 86	+1	4 13 0
Do. Def.	100	2	..	80 — 82	+8	2 8 9
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1⅞	1½†	42 — 43	..	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	106 —108	..	4 12 7
Do. Do. 1901	100	5	5	106 —108	..	4 12 7
Do. Do. 1908	100	5	5	107 —109	+1	4 11 9
Do. 4 % Deb.	100	4	4	97 —99 xd	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	5⅝ — 5¾	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5½ — 5⅝	+ ⅛	..
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1
Metropolitan Railway Consol.	100	1¾	1¾†	54 — 54½	—1	2 19 8
Do. Surplus Lands	100	2⅜	2⅜†	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	83 — 85	—1	4 2 4
Metropolitan District Ord.	100	Nil	Nil	39 — 39⅛	..	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	97 —99 xd	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	87 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	+1	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛ — 1⅜	+ ⅛	4 7 3
Do. Def.	1	Nil	..	—	+ 1/16	Nil
Do. 5 % Pref.	1	5	5	—	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	94 — 96	—1	4 13 9
Do. 5 % Deb.	100	5	5	95 — 98	—1	5 2 0
Potteries, Ord.	1	3½	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	—	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	—	— ⅛	Nil
Do. "A"	1/-	..	..	—	— 1/32	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	87 — 89	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	3	..	—	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5⅛†	—	— ⅛	5 8 6
Do. 2nd Pref.	5	5½	5⅛	—	..	5 17 4
Do. 4 % Deb.	100	4	4	92 — 94	+ ½	4 5 1
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	—	..	5 9 5
Do. 5 % Pref.	5	5	5	—	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	117 —121	+1	4 19 2
Do. 5 % Pref.	100	5	5	106½ —109½	+ ½	4 11 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	100 —103	— ⅜	4 2 6
Calcutta Trams, Ord.	5	7	5†	—	— ⅛	5 9 10
Do. 5 % Pref.	5	5	5	—	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	—	..	..
City Buenos Aires Trams (1904)	5	5	5†	—	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97 xd	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	—	— ⅛	..
Do. Pref.	1	6	..	—	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1⅛ xd	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	91 — 94	..	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	111 —115	..	6 1 9
Do. Gen. Con. 5 % Bonds	..	5	5	95½ — 97½	+ ½	5 2 7
Do. 6 % Bonds	100	6	6	98 —101	..	5 19 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	—	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	5	5†	145 —155	..	3 4 6
Do. 1st Mort. 5 % Bonds	..	5	5	100½—102½	..	4 17 7
Do. 5 % Mort. Bonds	100	5	5	96 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	260 —270	+5	3 14 1
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	—	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102 xd	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	— ½	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	—	..	8 0 0
Do. 6 % Pref.	1	6	6	—	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3½	..	4 6 2
Do. Pref.	1	6	6	—	..	3 16 10
British Aluminium, Ord.	1	Nil	..	—	..	..
Do. 6 % Cum. Pref.	1	Nil	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7⅛ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	8	Nil	Nil	—	..	Nil
Do. Deb.	100	4	4	59 — 62	—1	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	3	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	30 — 34	—2	13 4 8
Callender's Cable	5	15	10†	10½ — 11½ xd	+ ¼	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	38 — 39	— ⅛	5 6 8
Do. Deb.	100	4½	4½	105 —108	..	4 3 4
Crompton & Co.	3	Nil	..	—	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	—	..	..
Do. Pref.	1	6	6	—	..	6 8 0
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	—	..	Nil
Do. fully paid	5	Nil	..	1½ — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3⅜	—	+ 1/16	7 1 4
Do. Pref.	2	7	7	—	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12⅝	..	6 13 4
Do. Pref.	5	4½	4½	—	..	4 9 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10 — 11	— ½	..
Do. Pref.	10	5	5	—	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	97 —100	— ½	4 0 0
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	—	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

MORE NOTES ON ELECTRIC WELDING.

By V. D. GREEN.

(*Paper read before the* Birmingham and District Electric Club, *November 9th*, 1912.)

In a previous paper which I had the pleasure of reading before the Club in 1909, I dealt (somewhat superficially, I am afraid) with the general principles of electric welding and some of the chief types of apparatus employed. This evening I propose to deal in rather more detail with arc and butt welders, and to touch upon some recent developments.

Before going into the question of electric welding apparatus and machinery, it would seem advisable to consider some of the characteristics of the welds themselves.

A perfect weld may be defined as a union of the two welded parts so perfect that the tensile, compressive, and other properties of the resulting joint are as good as those of the unwelded metal. Perfection, however, is seldom attained in this world, and welds form no exception to the rule. We will, therefore, briefly consider some methods in use, electrical and otherwise, and see how near they come to our ideal. In a paper given before the Institution of Civil Engineers recently, the authors, who certainly had no particular bias in favour of electric or any other method of welding, found that, assuming a standard of strength at the weld of 70 per cent. of that of the unwelded material, electric welding by the Thomson or low-pressure alternating-current system gave much more reliable results than gas or arc welding.

The reason of this is not far to seek. The conditions of welding are, first, that there should be no oxide or foreign matter left in the weld; secondly, that the right temperature and pressure or "working" should be used; and, thirdly, that the heating effect should be stopped at the proper time so as to prevent actually fusing the metal. Now gas welding systems (and for that matter, electric welding by means of an arc) are fusion methods. Take the case of a broken shaft. If it is to be repaired by means of an arc or by gas, the broken ends are first turned down taper at the edges, so that when clamped together in position for welding a deep "V" is left. Into this the operator proceeds to fuse, bit by bit, new metal, until the weld is large enough to stand turning down to the level of the original shaft. Now everything evidently depends upon the operator. If he has the necessary skill, he has united the two parts with a circle of fused metal which is as wide as the "V" slot. But this fused metal has a totally different micro-structure to that of the original pieces, and as the finished shaft cannot well be moved from its aligning cramps until it has cooled, it is practically out of the question to "work" the metal by pressure or "tooling." When the operator has *not* the necessary skill, the result defies description, and will very likely fall to pieces as soon as the least strain is put upon it. As a matter of fact, the only way to get a really strong weld in a shaft by a flame process is to drill and tap both pieces, and let a stud of metal similar to the shaft half into one piece and half into the other, fusing metal all round the screw and the "V" slot so as to prevent it shifting afterwards. I have used this very successfully in welding crankshafts by acetylene.

Contrast this with the same done by means of the low-pressure alternating-current system. Here the heat, upsetting pressure and (in some machines where a swager device is fitted) the "tooling out" of the burr formed by the weld are all under perfect control. The heat, instead of being communicated to the weld from the outside by means of a flame (a method which is wasteful, and takes time), is created in the metal itself by means of the C^2R loss due to its own resistance. The shaft to be welded is clamped in the welding jaws, with a suitable distance piece between, so as to allow for the "shut" of the weld, if it is necessary that the overall dimensions of the finished shaft should be the same as before. The electrical and mechanical adjustments being set, the current is turned on, and in a few seconds the metal, unobscured by any flame, has heated to the plastic stage, "upset" the predetermined amount, and stopped its own current. The resulting weld is not an uncertain fusion, but a true union of the two opposing surfaces. In spite, however, of obvious disadvantages, gas and arc welding are being extensively used for many purposes where great strength is not essential, and where handiness and portability are of more importance than the actual cost per weld or the speed of turning out the work. Moreover, there are many cases where it is only possible to apply one of these systems successfully. The man who tried to patch up a broken casting with a low-pressure welder would see trouble, and it would be equally out of the question to make harness rings on a commercial scale with an arc set. The principal field of the former will always lie in the rapid repetition of standard parts or repairs to finished work where the heating must be strictly localised, while the latter is usually more useful for jobs such as repairing broken castings and work which must be done in position.

In the Benardos arc welding process which is most commonly used, the arc is formed between a carbon rod of specially prepared material which is not readily consumed and the work to be welded. The sizes of the carbons vary considerably, but the samples before you will give you a fair idea of the average dimensions. In order to minimise the risk of carbon being deposited on the work the welding tool should be made the negative pole, where direct current is used, when welding such work as iron or steel castings or any alloys where the presence of carbon is objectionable. When the arc is used only for brazing or soldering, this point is not of so much importance, and as brazing sets are generally handled by men whose knowledge does not extend to an appreciation of the properties of an electric circuit, it is usually preferable to connect the anvil and work to the earthed main of the supply system irrespective of its polarity. The welding tool is always treated with respect, because the flame obviously proceeds from it, but the idea of the anvil being also "alive" is not so evident, and if the operator receives an unpleasant reminder of the fact, his views on the process are apt to be biased. One of the great advantages of arc welding over the Thomson low-pressure or "resistance" method is that practically unlimited heat is available (a matter of great importance where patching defective castings or cutting metal is to be done), without unduly increasing the weight of the apparatus

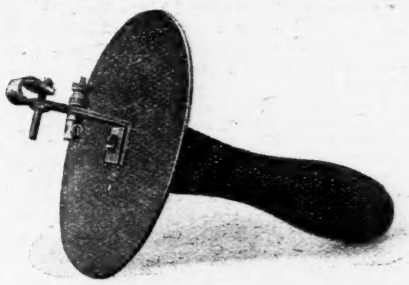


Fig. 1.—Small Arc Brazing Tool.

to be handled. In this connection the small welding tool before you will be of interest. Most of the cable work on our demonstrating plant was soldered up with it, and the resulting work was not so much blackened as would have been the case had an ordinary paraffin blow lamp been used, while the insulation of the cable was less affected by the heat. The regulation of the heat was effected by a lamp plug board, and I propose to demonstrate the practical application of it for soldering. The object of the resistance is, of course, to break down the 110 volts pressure of the dynamo to that necessary for the arc, and for steadying and regulating the arc when formed. I trust also to show the use of the arc for cutting metal instead of sawing, where extreme accuracy is not essential. As a matter of fact, however, the current should be about 500 amperes, instead of the 200 I am about to use. In this connection it has always appeared to me that an arc plant would be very useful for cutting off the "risers" or "gates" left on castings, instead of dealing with them in the usual way.

The principal inherent disadvantages of the arc process are :—

1. The results obtained depend entirely upon the skill of the operator, and so cannot very well be made automatic for repetition work.

2. It is not so safe as the "resistance" method, owing to the comparatively high voltage used, the sparks thrown off when large work is being done, and the chemical effect of the ultra-violet rays on the skin, unless the operator is well protected by asbestos gauntlets, apron, and metal helmet with non-actinic glass eye-holes. It then becomes rather difficult for him to see what he is doing. These remarks apply, of course, chiefly to large work, and for small brazing sets elaborate precautions do not appear necessary, although suitable dark red glasses should always be used. The results of exposure to the ultra-violet rays of the arc are curious. The skin is tanned, and peels off in the same way as when exposed to very bright sunlight. It is, however, more unpleasant than dangerous.

3. The difficulty of keeping the arc reasonably steady becomes more and more serious as the work to be done becomes smaller. The temperature of the arc itself is very high, and cannot be altered to any great extent, so that the only way to decrease the heating effect is to reduce the volume of the flame. Up to a certain point there is not much difficulty in doing this, because it is only necessary to cut in more resistance, and so decrease the current. But in dealing with finer work, such as hard soldering a brooch, the flame has to be narrowed down to the equivalent of a thin blow-pipe flame, and as the stability of an arc decreases rapidly as the ratio of length to width increases, a point is soon reached when the electrode has to be held so near the work that it is difficult to see what is happening. It is obvious that this point will be reached sooner with alternating than with continuous current, and it is for this reason that continuous current is nearly always used, though, as you have already seen, the use of alternating current is quite practicable on a larger scale.

The voltage across the arc varies from 50 to about 150 volts, and the current from ·5 ampere to about 500 amperes, according to the particular job in hand. Where arc welding plays an integral part in the manufacturing processes of a works the method of breaking down the mains pressure through a resistance is nearly always too costly, besides making the users an utter nuisance to everyone else on the same supply feeder main, and a specially wound motor-generator or power-driven dynamo having a pronounced falling characteristic is usually installed. I propose, however, to deal with the question of generating and converting plant on another occasion.

In most manufacturing processes where welding is required, modern competition demands great accuracy in the finished article, low running costs and a large output from each operator. This accounts for the steadily increasing use of the low-pressure alternating system first introduced by Elihu Thomson in 1885. As has been previously mentioned, the principle consists of causing very large currents to pass through the abutting ends of the pieces of metal to be welded, thereby causing heat to be generated at the point of junction, which is, of course, the point of highest resist-

ance. At the same time mechanical pressure is applied to force the parts together. As the current heats up the metal at the junction to the welding temperature, the pressure "follows up" the softening surface until a complete weld is effected, and as the heat is developed by the C^2R loss in the metal itself, all parts are equally heated.

Referring to the strength of the welds made by this process, Sir Alexander Kennedy made tests at the request of the Thomson Co., and reported as follows:—"I have tested the bar, both welded and in its natural condition, and the result of both tests is given in the tables. In the case of the wrought-iron bars, the ratio of the welded to the unwelded bar is as follows:—2 in. diameter, 82 per cent.; 1½ in. diameter, 84 per cent.; 1 in. diameter, 87 per cent.; ¾ in. diameter, 98 per cent.; ½ in. diameter, about 95 per cent.; mean ratio, 89 per cent.

"In the case of the ½-in. bar the pieces tested broke very close to the weld. There was not enough bar left to enable me to make separate tests of the bar in its natural condition. The 95 per cent., therefore, is in the nature of an estimate. Of course, in all cases the durability of the metal in the neighbourhood of the weld, as measured by its ultimate extension and reduction of area, is less than elsewhere, as the figures in the report show. The ratio of strength of weld to solid bar in the case of the Bessemer steel specimens is as follows:—1 in. diameter, 92 per cent.; ¾ in. diameter, 97·5 per cent.; ½ in. diameter, 100 per cent.

"In this case, it will be seen that with the ½-in. bar the metal was somewhat hardened by the heat, so that it was actually stronger at the weld than the metal was in its natural condition, as shown by the occurrence of fracture through the solid bar, and not through the weld."

It will be noticed that apparently the strength of the weld decreases with increasing cross-section; but, in my opinion, the results obtained merely show that the machine on which the above samples were welded was too small to deal properly with the large sizes. There is always one particular speed and setting which gives the best result for a given weld, and there is apparently no reason why all the sections tested should not have averaged the same breaking stress.

The following test made upon some No. 7 S.W.G. iron wire rings turned out by one of our semi-automatic welders will also illustrate the reliability of the finished work produced by this process:—(*a*) 1,696 lb. breaking pull, broke at weld; (*b*) 1,249 lb. breaking pull, broke above weld. The solid wire itself, on being tested, broke at 1,325 lb., showing that the metal close to the weld was slightly weaker than the rest of the wire.

The heat is produced where it is wanted, and practically confined there. None is wasted in maintaining an arc. The power therefore is economically employed, and the welding may be continually watched, as it is not covered with flame or obscured in any way. So local, indeed, is the heating that finished work may in many cases be welded without spoiling the polish for more than a quarter of an inch on either side of the weld. This process may be made automatic, and thus uniformity of results may be obtained, an important matter where large quantities are dealt with. Moreover, it is extremely rapid, being practically instantaneous for small sizes, while for larger sizes only a few seconds, depending on the horse-power used, are required. With regard to the horse-power necessary for various kinds of work, the following figures may be of interest:—

ROUND IRON AND STEEL.

Dia.	Area sq. in.	H.P.	Seconds.	B.T.U. per weld.
¼ in.	0·05	2·0	10	0·004
⅜ in.	0·1	4·2	15	0·013
½ in.	0·22	6·5	20	0·027
⅝ in.	0·3	9·0	25	0·046
¾ in.	0·45	13·3	30	0·082

These figures are taken from actual tests, and are not to be regarded as the best which can be got. It should be remembered that although the total energy required to do a given weld remains much the same whether the operation is fast or slow within certain limits of speed, the ratio of power required to time occupied may be considerably varied.

If, however, the rod is bent into a ring, and the ends welded, allowance must be made for the current which will be shunted round the other side of the ring. The amount so shunted depends naturally on the diameter and length of the rod or wire composing the ring. The times given above are rather slower than those obtained in manufacturing work, because it is usually preferable to lose a small percentage of the strength of the weld in order to keep down the labour costs. As long as it is amply strong enough for the purpose for which it is intended, it would be bad policy to treble the production costs for the sake of making the job unnecessarily strong. Of course this speeding-up may easily be carried too far. The commercial limits may be taken as follows:—

1. The power required to hasten the weld rises in a curve which, although comparatively straight at first, bends sharply upwards when the time is very much reduced, and this renders it uneconomical to press the speed of welding too high. The curves shown will illustrate this point forcibly. The running cost is usually so small compared with the labour charges, that it would pay to reduce the times given in the above table down to about one-fifth of the values there given, but beyond that, the capital cost and size of the plant increase beyond a practical limit.

2. The quality of the metal also plays an important part in the speed limit. When you can choose your own speed, it is possible to weld nearly anything in the way of iron and steel that you can get, but where the pace has to be forced it becomes more and more essential that the material should be soft, homogeneous, free from impurities and slag, and consistent in quality. It must be remembered that this paper is not intended to be anything but a practical description of the subject, and while I have personally welded fairly bad stuff successfully at a high speed, it was under laboratory conditions, which would rarely be reproduced in commercial working. Where the weld has been speeded up beyond the limit, and is weak in consequence, it does not always give way at the point of the junction, as shown in the test of the 7 S.W.G. wire already mentioned, but sometimes at a point about midway between the actual

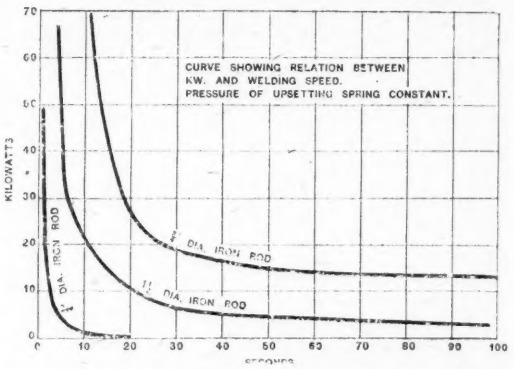


FIG. 2.—RELATION BETWEEN WELDING SPEED AND KILOWATTS (Pressure of upsetting spring constant).

weld and the point where the metal was held in the die. This is due to the sudden heating of the weld. No time is given for the heat to spread backwards into the rods, with the result that there is a sudden line of demarcation at either side of the weld, where the micro-structure of the metal changes from the silky fibrous section of the wrought bar to a succession of "slip bands," and thence to a mixed-up fused mass. The joint (one cannot call it a weld) is then no better than an acetylene or arc weld, and will break at the point where the micro-structure changes. It has long been the fashion in papers on the subject of welding to point with pride to the fact that the metal has broken before the weld, but if the break is close up to the weld, the tensile test should be retried, and if the material falls below a reasonable standard of strength and the break occurs in the same place every time, the welding methods should be altered.

3. The shape of the work has frequently a considerable effect upon the welding speed. Thus, in the manufacture of rings, this limit of welding is usually reached (other things being equal) when the ratio of the diameter of the ring to the diameter of the stock from which it is made becomes less than 5 : 1. This does not mean to say that it is impossible to weld below that size, but merely that there is liable to be trouble when working on a commercial scale unless the operator is very skilful.

4. The fourth point is the welding machine itself. From the foregoing, it is evident that the practical limits of the actual welding time are quickly reached, and any further speeding-up can only be obtained by decreasing the time required to handle, clamp, release, &c., the stock. This means additional cost and complication, and greater chances of mechanical trouble, since the machine must be more or less completely automatic. This, in turn, means that the setting-up of the machine and its adjustments must be done with extreme care, and unless the works are large enough to pay for a thoroughly skilled fitter, familiar with automatic welding machines, to adjust and repair them, a simpler type is preferable, for it must not be forgotten that a very little wear will upset the adjustment, and the machine will turn out scrap quite as fast as good work.

5. The work itself—that is, the accuracy of the processes previous to welding—plays an important part. It has been shown that an accurate machine is necessary for high-speed work, and it follows that it is no use having a machine which will work to $\frac{1}{100}$ in. if the work supplied to it varies ⅛ in. or so. From these considerations it is evident that there comes a point somewhere where the added working and capital costs outweigh the advantage of the gain in speed. This point, however, differs according to the class of work, and depends on an equation which each manufacturer must solve for himself. Personally, I think that the simpler the machine can be kept the better, and my opinion is endorsed by many manufacturers who have had experience of both hand automatic and completely automatic machines.

So far, we have been dealing with tables of round rods and bars, but when the stock is of square or oblong section, the power requisite to weld it rises, on account of the greater radiating surface in proportion to the mass. In the curves just shown it will be noticed that they gradually become horizontal, showing that below a certain KW. input it is impossible to raise the stock to the welding temperature at all, and that the radiation and convection losses balance the heating effect. The difference, however, is not necessarily proportionate to the relative cooling surfaces for equal speeds of welding, and, therefore, we may fairly conclude that in practical working the radiation and convection losses are not, as a rule, serious. To take an instance, a ½-in. inside diameter pipe, having a cross-section of metal equal to that of a ⅜-in. diameter round rod, requires not ·046 unit to weld it but ·061. This is an increase of only about 32 per cent., whereas the relative cooling surfaces are approximately 3 : 2. The mechanical pressure, however, has usually to be much heavier with strip and tube than with ordinary bar, and this makes reliable comparisons diffi-

cult to obtain. In order to determine the effect of radiation, conduction and convection on sections of differing shape but equal area, it is necessary to do away with the disturbing element of the mechanical pressure, and I decided therefore that the test must be on fusing a bar, and not welding it. I therefore obtained a piece of $\frac{3}{8}$-in. diameter round iron, having an area of '1075 sq. in. in cross-section, and a flat strip $\frac{1}{10}$-in. thick, having an equivalent area. I then slacked off the "upsetting" springs of the welder so that there was no mechanical pressure, and heated each sample until it broke. The power in units was '044 for the bar, and '1532 for the strip. This is, however, an extreme case.

Let us turn now to the question of the material to be welded. Where iron is dealt with it should be as soft and pure as possible. Iron of this character is to be had, and I know several wire mills which are making a speciality of iron suitable for electric welding. Mostly, however, the samples to be dealt with are a very long way off being pure, and are often "burnt" besides, common Staffordshire iron being probably the greatest offender in this respect. It is by no means impossible to weld it, but the machine has to be set rather more accurately than for the purer iron, and the chance of making scrap under commercial conditions is much greater owing to unlooked-for variations in the quality of the metal.

Mild steel is usually the best possible material for welding which can be readily got anywhere, though the term is rather an elastic one, and I have come across stuff which certainly conformed to specification in so far as a low carbon percentage was concerned, but which contained so many other unscheduled constituents that it was impossible to do anything with it.

I have never done much in the way of experimenting with cast-iron, though I have produced fairly strong welds in this material. Mostly, however, it is cast into shapes which preclude the possibility of getting the parts to be united into the jaws at all, so I never pursued the subject far.

The welding of high carbon steels, copper, nickel, brass, &c., is a fascinating subject. I have already mentioned the conditions necessary for a good weld, and in iron and mild steel all these are fairly easy to fulfil. With high carbon steels one encounters the difficulty that outside a very limited range of setting the carbon tends to be converted into CO and CO_2, and the weld is "burnt."

(To be continued.)

BRITISH TRADE IN ROUMANIA.

ROUMANIA is necessarily one of those countries where the buying power both of the public bodies and individuals depends from year to year on the results of the harvests. For this reason, traders must keep a close watch on movements, and regulate their efforts according to conditions which exist at the moment. At the same time there are excellent opportunities in Roumania, particularly for constructive work, but Continental competition is very keen.

In a recent report on the subject of the trade of Roumania, H.M. Consul at Bucharest points out that to gauge thoroughly the Roumanian market for commercial purposes, it is necessary to keep the agricultural prospects in view. Everything depends on the harvest. If two years of plenty follow one another, then business all round increases to an incredible extent, and *vice versâ*. Thus, 1910 was a good year, but for the preceding three years the harvests were poor, and the result is that the bulk of the profits made in 1911 will go to liquidating arrears and debts contracted in the previous years. Should the next year fulfil present expectations, then the following period should be one of great commercial prosperity.

It is to be regretted that more direct business is not done between the United Kingdom and Roumania. It is a fact that the Roumanian market is looked upon with suspicion by British merchants and capitalists, and there can be no doubt that much capital has been lost both by individuals and firms, but this is attributable in a great measure to want of caution in selecting the persons with whom business is to be done. On the other hand, there are representatives of firms who have been dealing with Roumania for a number of years, and who claim to have made practically no debts.

The country is exceptionally fertile. The mineral resources are practically untouched, and the petroleum industry, though it has assumed important proportions, may be said to be still in its infancy.

In view of the above and other advantages, and the desire for development and the activity of the Roumanian people, it seems apparent that British capitalists and manufacturers could find scope for their energies. But it should always be borne in mind that more British capital has been lost in Roumania through worthless agents and bad connections than through any other cause.

Owing to the great facilities afforded by the Orient express, London is within less than three days' journey of Bucharest, and it is to be regretted that more British merchants and prospective investors do not personally visit Roumania and thus study the market and local conditions on the spot.

British merchants find keen competition in this market, though there can be no doubt that if statistics were available discriminating more exactly the origin of goods, it would be found that we command a good share of the trade. British cottons and textiles undoubtedly successfully compete with all others. Our principal competitors are Germany and Austria-Hungary, Italy to a small degree, and of recent years Russia as far as locomotives and cheap machines are concerned.

The principal cause of successful foreign competition may be traceable to the question of transport and freight. German State Railways convey goods at cheap rates to the Austro-Hungarian frontier; thence it is but a short run to the Roumanian frontier over Austro-Hungarian rails, where freights are notably cheap. Goods coming from Austria-Hungary and Germany—our commercial rivals in Roumania—can be ordered and delivered in from 10 to 15 days. British goods take from three to five weeks, and if despatched by sea may take an indefinite period. This could be mitigated if an enterprising line of steamship owners were to run a regular direct service from the United Kingdom to the Danube. At present, freights from the United Kingdom overland and by sea show very little difference. But merchants cannot afford to trust to their orders arriving to date if sent by sea.

The question of credit is one that also affects competition. British merchants frequently exact cash against documents or three months, and exceptionally six months. The foreign firms are more lenient, and give six months, 12 months, and even more. In Roumania credit is essential, and with a competent agent, who thoroughly knows his market and customers, there is no reason why easier terms should not be given. As an example of the extremes to which the question of credit is carried, the Consul quotes the case of a British firm that obtained a small and insignificant order from the Roumanian Government. When it came to the question of terms, the firm insisted on cash against documents, evidently ignoring the fact that the Government disposes of a revenue of some £18,000,000. Naturally, the terms were not agreed to, and the order went elsewhere.

The following electrical goods are imported:—Dynamo-electrical machines, electric motors, rotary converters, dynamo accessories, accumulators with plates for recharging, arc lamps and their mechanism, telegraph and telephone apparatus, bells, batteries for medical and chemical purposes, switches, wire and cables covered with metal, paper, asbestos, gutta-percha, rubber, &c., incandescent lamps, insulators and articles for insulation in earthenware or porcelain. Ventilators are used to some extent in banks, hotels, hospitals and public institutions. Cinematographs are extremely popular in all towns in Roumania. The steady development of home industries in Roumania is favourable to the import trade in electrical goods. The market is the object of keen competition between the United Kingdom, Germany, Austria-Hungary and France. Manufacturers, in order to succeed, should be represented in Roumania; sending catalogues alone is useless. The essential qualities in goods destined for Roumania are cheapness, simplicity and good wearing quality.

Whether British firms avail themselves of the services of commission agents or not it is highly desirable that in opening up business relations in the district they should send out their own agents to establish at least their first connections, and also it is absolutely essential for such men to be capable of transacting their business either in German or in French, failing Roumanian. If the British firm employs a commission agent, it should, in its own interest and before allowing credit to be given, require satisfactory proofs from him that the buyer is solvent and in a good way of business.

THE ABANDONMENT OF A TRAMWAY.

[FROM A LEGAL CONTRIBUTOR.]

IT is material for those who have power to run a tramway, but contemplate its abandonment, to remember that abandonment may have a serious effect on what is known as the Parliamentary deposit. In case the abandonment of tramways may take place more frequently in the future, owing to the competition of the motor-'bus, it may be useful to set forth some of the considerations which may affect the Parliamentary deposit, more particularly in view of the case of *in re* West Yorkshire Tramways Bill, 1906, which was decided on October 31st by Mr. Justice Warrington.

Where a tramway is abandoned, the Court, by virtue of the Parliamentary Deposits and Bonds Act, 1892, has power to order that the deposit, or any part thereof, be applied towards compensating any landowners or other persons "whose property has been interfered with or otherwise rendered less valuable by the . . . . abandonment of the undertaking or any portion thereof."

It has been held that the measure of injury due to abandonment is determined by a comparison of the value of the estate immediately before and immediately after the abandonment (*in re* Potteries, Shrewsbury and North Wales Railway Co. (1883), 25 Ch.D. 25), and that account may also be taken of a breach of a collateral obligation if it is such that a breach of it is necessarily involved in the abandonment and indistinguishable from it (*in re* Ruthin Railway Act (1886), 32 Ch.D. 438). That it must be "necessarily involved" was made clear in a case decided in 1911. Where, for instance, the making of a tramway might involve the erection of an embankment which would keep water from the plaintiff's land, the abandonment of the tramway, and the consequent non-erection of the embankment, will not give rise to a claim for compensation. In the case in question a company was authorised by Act of Parliament to construct a tramroad, which would cross land belonging to the respondent, "with all necessary and proper embankments," &c. By Sec. 50 of the Act, it was provided that the deposit made upon the application for the Act in pursuance of the Standing Orders and the Parliamentary Deposits Act, applicable to (*inter alia*) compensation "to landowners or other persons whose property has been interfered with or otherwise rendered less valuable by the commencement, construction, or abandonment of the tramroad" authorised by the Act. The company, in pursuance of an agreement made by them with the respondent before the passing of the Act, subsequently thereto entered into an agreement

with him by which the respondent agreed to convey certain lands to the company, and to grant to them by way of easement the right of constructing and maintaining upon certain marsh lands belonging to him "a solid embankment for the purpose of carrying the company's authorised tramroad across the marsh lands," and the company agreed to "construct and thereafter maintain the embankment for the purpose of carrying the tramroad across the marsh lands in the manner aforesaid" as a solid embankment and to form it so as to connect certain existing sea banks, and to be sufficient to prevent the ingress of the tidal waters of a river over land belonging to the respondent. This agreement was followed by a conveyance by which the before-mentioned easement was granted to the company, and which contained a covenant by the company to execute and perform the works specified in the agreement. The proposed tramway was never made, and the company obtained an Act by which it was provided that they should abandon the same, and provision was made for the appointment of a liquidator and the winding up of the company. In proceedings in the Chancery Division in the matter of the application of the deposit fund, the respondent claimed against that fund in respect of diminution of the value of his property by the abandonment of the company's undertaking and the consequent non-construction of the embankment, which would have protected his above-mentioned land from liability to be overflowed by the tidal water, and Warrington, J., being of opinion that the respondent was a landowner whose land had been rendered less valuable by the abandonment of the company's tramroad within the meaning of Sec. 50 of the Act, allowed him to claim against the fund. On appeal by the liquidator of the company, it was held, reversing the decision of the learned judge, that the non-construction of an embankment in accordance with the covenant was not a necessary consequence of the abandonment of the company's undertaking, and, therefore, the respondent was not entitled to compensation out of the deposit fund as claimed by him.

In the case before Mr. Justice Warrington, it appeared that a landowner had entered into an agreement with promoters to sell to them a part of the site of a corner shop. The sale was carried out voluntarily. Under their Act the company were empowered, but were not obliged, to widen the road at the point in question, and the exercise of this power might have resulted in a piece of the applicant's land fronting on the street, which would have increased its value. The claimant alleged that he was entitled to that added value as compensation. Mr. Justice Warrington held that the diminution in value was occasioned not by the abandonment of the tramway, but by the fact that the street was not widened. "Under the Act," he pointed out, "the street need not be widened: even now it might be widened. The applicant was not injured by the abandonment of the tramway, although he might have been through the street not being widened. I am of opinion that the applicant does not come within the class of persons whose property has been interfered with or otherwise rendered less valuable by the abandonment of the tramway."

It is a nice point whether the loss of the advantage of having the tramway running past the door of his house would be such as to entitle a frontager to compensation. It is submitted (in the absence of any definite authority) that it would not. It was, however, held in one of the cases above-mentioned that where the abandonment of a railway involved the non-erection of a station, a landowner was entitled to show that failure to build the station had affected the value of his land.

THE MANCHESTER STEAM USERS' ASSOCIATION.

The annual report of this Association for 1911 is to hand. Owing to the coal strike, it commences with a reference to liquid fuel, and a table is given to show the relative values of coal and crude oil for equal economical results. The figures given range from 35s. per ton of oil to correspond with 26s. for coal, up to 60s. and 45s. respectively. Thus, the price of oil must fall considerably before it will pay to burn it for steam raising. The chief advantages of oil are the absence of ashes and clinker, but the report says oil must be burned in brick-lined chambers, which need frequent repair or renewal. But it is now claimed that with even simple pressure burners a large unlined marine furnace will burn oil smokelessly, and the Wallsend Slipway Co. now install oil fuel installations on this system. The efficiency of the internal-combustion engine is approximately double that of the steam engine. A week's oil consumption of 55 hours may be stated at 0·5 lb. per B.H.P.-hour in an internal-combustion engine. For equal economy crude oil at 35s. in a Diesel engine, petrol in a Diesel engine at 44s., coal for producer gas at 11s. 6d., coal for a gas-fired boiler at 8s. 6d., and coal for a steam engine at 10s., are at par, according to this report. Thus, at present prices fuel for the Diesel engine costs twice as much as for a steam engine—ashore, we may conclude, is alone meant. The report suggests the production of cheap gas at a central station, and its piping round to factories. This, by the way, would also solve the factory heating problem, for the exhaust and jacket heat would do this, or there would be the gas itself if more heat were wanted.

This heat problem is the principal trouble in the way of transmitted electricity, and the report says that if one boiler is necessary at a factory it may just as well be big enough to drive the power plant, for one stoker can do the work in most factories. Obviously the Association would advise the generation of electricity at a factory rather than at a central station, and for Lancashire mills which must be heated almost all the year round it is not easy to see the advantage of a central station, which cannot usually even buy fuel at a less cost than the factory, and has the disadvantage of a worse load factor and of a line loss and other charges also. And how much worse would the case be if only the factory owner would use the vast stream of waste heat with which he now heats to 100° F. or more a great pond or a length of canal, when he is burning coal for mill heating that he could so well save.

As the report says, boilers give trouble; not the least is corrosion, and considerable attention is given to this. Internal boiler corrosion is due almost wholly to the oxygen and carbonic acid of the air, which are absorbed by water, and reference is made to the experiments of Heyn and Bauer at some length. The experimenters tested the effect of 40 dissolved salts in reducing or increasing corrosion. These salts included those of calcium, sodium, potassium, ammonium, iron, barium, chromium, magnesium, and boron. The calcium and barium salts did not cause pitting, but sodium salts added to lime salts did. The worst pitting occurred with sodium chloride and sodium carbonate mixed. Some salts attacked central regions, others affected the outer regions of plates. Corrosion from electrolysis is most erratic, it being not uncommon for one boiler in a set to corrode much faster or much more slowly than the remainder.

Except the acetate, all the ammonium salts are corrosive. Steam users afflicted by abnormal and rapid corrosion should analyse the water, for corrosion is a far more complicated affair than has been suspected; it has been thought to be sufficiently guarded against by common soda, whereas this salt mixed with the chloride may be most pernicious. High pressure has very much altered boiler conditions. It will decompose magnesium chloride and produce the acid base HCl. It will causticise sodium carbonate and so cause corrosion of brass mountings. Most of the oxygen in water soon passes into the steam space, but the small amount left behind in the water should be removed by the continuous addition of a deoxydiser with the feed.

Aluminate of barium or Ba O, $Al_2 O_3$ combines with both carbonic and sulphuric acid, and both lime and alumina are deposited. Water thus treated is therefore nearly as pure as distilled water, but is not fit for domestic use, because barium is poisonous. But are not the resulting barium salts insoluble? Not all barium salts are insoluble, if most of them are. If those produced in water softening are not soluble, such a treated water if filtered ought to be good. But barium has so very high an atomic weight that great weights of it must be used to cause lime or magnesia—both bodies of small valency—to deposit. A return to the subject is promised in the near future. The report contains a reference to permutit and the luminator apparatus, if a sheet of corrugated aluminium can be called an apparatus. Its action appears to be without waste of itself to cause lime salts to go down as fine powder instead of as hard scale. Permutit is stated to be too costly to remove lime carbonate, for 70 lb. of common salt are needed for each 100 lb. of lime carbonate precipitated. For sulphate of lime permutit stands a better chance, for to remove 100 lb. of this only 60 lb. of salt is needed [the report says 600 lb., but this appears to be a misprint]. But both permanent and temporary hardness removal seems to be outside the practical power of permutit. Permutit is a double salt with the formula 2 Si O_2, $Al_2 O_3$, Na_2 O, $6H_2$ O. [Should not the second item be $Al_2 O_3$?] This is a most interesting and thought-compelling report, and is well worth the reading. On the luminator puzzle a domesticated friend assures the writer that an aluminium kettle will not become encrusted by hard water, but will cause scale-forming matter merely to deposit as loose powder. If this is so, it would appear that the placing of a luminator plate in the magnetic meridian is a mere selling point.

Perhaps we may yet have aluminium boilers?

British Railway Electrification.—In a letter to the *Morning Post*, "Fair Play" calls attention to a rumour to the effect that the engineers of the A.E.G. have made a survey of the London-Brighton railway, while British engineering firms show no sign of activity in connection with the pending contract for the conversion of the railway to electrical working. The writer of the letter protests against the employment of a foreign firm to carry out the work, pointing out that if this is done, the fact that British electricians are not trusted by their own countrymen to undertake British work will be advertised by their competitors all over the world. We may be assured, he says, that material to be used in construction has been bought from British firms, but the assurance is worth little unless we know that those firms have not bought the material from Germany in the first instance; if the A.E.G. secures the contract and gives long credit, with the aid of the banks which finance it, the latter will not allow their money to be spent on goods manufactured out of Germany, and German material will have to be used, even though it may pass through the hands of a British firm. Finally, he alleges that a very grave blow to the British electrical industry is in preparation, and asks whether the British houses and the British public are going to take it lying down.

ELIMINATION OF COLOUR DIFFERENCE IN THE PHOTOMETRY OF INCANDESCENT LAMPS BY MEANS OF MULTI-VOLTAGE STANDARDS.

By DAVIS H. TUCK.

The unit of illumination intensity, mean horizontal candle-power, in the United States and England is based upon the performance of carbon and tungsten-filament incandescent lamps when they are operated at a fixed efficiency, the carbon

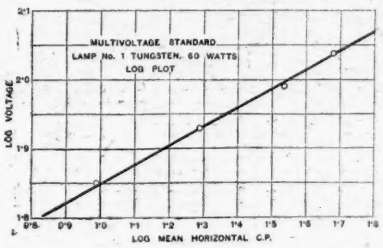


Fig. 1.

lamps burning at an efficiency of 4 watts per mean horizontal candle-power, and the tungsten lamps burning at an efficiency of 1·50 watts per mean horizontal candle-power.

When carbon-filament lamps or metal-filament lamps burning at an efficiency other than 4 watts per mean horizontal candle-power, or 1·50 watts per mean horizontal candle-power, are to be compared with primary standard lamps or duplicates of primary standard lamps, the different colour resulting from the different operating efficiency makes the operation of comparison a very difficult one when accurate results are desired and the time to obtain these results is limited.

When different observers make photometric measurements on lamps which operate at an efficiency different from that at which the primary or secondary standard lamps are calibrated, different results are obtained, and different experienced observers will repeat their readings from day to day. With this in view, it will readily be seen that to obtain accurate candle-power values for lamps which burn at a different colour from that of the standards with which they are compared, it is necessary for a large number of experienced observers to make independent measurements from day to day, and the mean of these measurements taken as the true candle-power value of the lamps.

Several combinations have been more or less successfully used to eliminate the difference in colour of the light which falls on either side of the photometer screen, and such com-

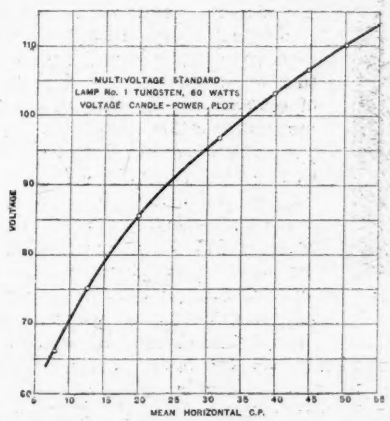


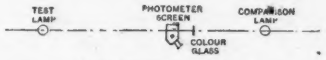
Fig. 2.

binations are indispensable when a large number of lamps are to be accurately calibrated in a limited time. The flicker photometer is used in some laboratories to eliminate the colour difference between the standard lamp and the test lamp, but the reliability of such data is questionable. Coloured glass is also placed in the path of the light to reduce to the same colour the light which falls on either side of the photometer screen. Several sources of error are likely to occur when coloured glass screens are used. A very large number of coloured glasses would have to be calibrated so as to obtain a colour match with all types of lamps, and such a calibration would involve an enormous amount of labour. The question of permanency of the density of the coloured glass arises, and it is necessary to make check measurements at frequent intervals.

By the adoption of the procedure outlined below, it is possible to make comparisons of lamps operating at different colours once and for all at some convenient time and to make all subsequent comparisons under the favourable conditions of a colour match.

A group of tungsten-filament lamps should be selected which are so constructed that the filaments are strongly anchored, and at the same time the current comes to a steady value in less than 45 seconds. Select four voltages which will operate these lamps at different efficiencies between 4 watts per mean horizontal c.p. and 1·25 watts per mean horizontal c.p.

At these voltages let five or more experienced observers make at least nine independent candle-power determinations using carbon or tungsten reference standards.

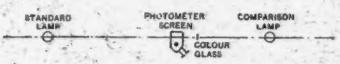


Arrangement No. 1.

In the table below are given the candle-power and corresponding voltage values of a 60-watt tungsten lamp. The candle-power values given represent the mean of nine measurements for each observer.

	Lamp No. 1, 60-watt tungsten. Volts 107·5. M.H.C.P.	Lamp No. 1, 60-watt tungsten. Volts 88·0. M.H.C.P.	Lamp No. 1, 60-watt tungsten. Volts 85·0. M.H.C.P.	Lamp No. 1, 60-watt tungsten. Volts 71·0. M.H.C.P.
Observer A	46·84	34·23	19·60	9·81
„ B	47·10	34·10	19·60	9·85
„ C	46·80	34·21	19·72	9·76
„ D	46·77	34·08	19·68	9·83
„ E	46·80	34·12	19·57	9·79
Mean	46·86	34·15	19·63	9·81

If the logarithms of the voltage values be plotted against the corresponding logarithms of candle-power, the mean values being used, the resulting curve will be a straight line. Such a plot, made from the above data, is shown in fig. 1. If values are read off from the logarithmic plot, and the



Arrangement No. 2.

numbers corresponding to these logarithms are plotted into a direct plot, the candle-power voltage curve shown in fig. 2 may be constructed. It will be noticed that to construct such a curve from direct data would require a prohibitive amount of work.

When the candle-power voltage curves have been constructed for a group of multi-voltage standard tungsten lamps, all subsequent comparisons of test lamps may be made against these multi-voltage tungsten standards when these lamps are operated at such a voltage as will produce a colour match with the test lamps. The procedure is the following :—

(*a*) Using the substitution method, adjust the voltage of the comparison lamp to give a colour match with the test lamp when the test lamp is operated at the voltage at which it is to be standardised. If necessary inert a blue glass colour screen between the photometer screen and the comparison lamp. See arrangement No. 1.

(*b*) With the voltage of the comparison lamp at the value as found in operation "*a*" and the colour screen, if used, in place, adjust the voltage of the multi-voltage tungsten standards to give a colour match with the comparison lamp. See arrangement No. 2.

(*c*) Use the multi-voltage tungsten standard lamps at these voltages as standard lamps with which to compare the lamps that are to be tested. See arrangement No. 1.

When the apparatus is designed to move the photometer head and the comparison lamp as a unit, it is advisable to use a carbon comparison lamp, and in such a case it is necessary to use a blue colour screen, as shown in arrangement Nos. 1 and 2, when high efficiency test lamps are to be measured. The glass screen, however, is kept in the same position throughout the entire test so that it is not necessary to calibrate it.

The above method has been found very convenient by the author when groups of lamps of different efficiencies are to be accurately calibrated.

A REMARKABLE COAL-GAS ENGINE.

[COMMUNICATED.]

In these days, when our competitors abroad are devoting so much attention to the internal combustion engine, any outstanding development in this country deserves—and obtains—a most careful attention. In this direction the engine that has been invented by Dr. Archibald Low (D.Sc.) for working on coal, has reached a point of development when it can already claim improved results over existing practice, and the fact that the writer was recently able to study the working of one of these engines, encourages him to think that the particulars then obtained may be instructive to others.

Crudely, the Low engine may be described as running on gas obtained from coal, in a producing plant so compact that the complete plant constitutes nothing more than an elaboration of the cylinder head casting. Obviously, gas production under such conditions necessitates a special system.

Although the idea which this engine embodies has been the subject of seven years' continual study and experiment, inevitably involving trials of various sizes of engines, for the present purposes the writer cannot do better than take for description the machine that he watched at work. This is a large single-cylinder 80-100 H.P. engine of usual horizontal design, merely modified to meet the requirements of the special idea. To this end the 16-in. cylinder head has been replaced by a casting extending somewhat to each side of the cylinder. This casting is made up of various chambers. Looking at it from behind the cylinder, on the extreme left is the hopper chamber, and small coal is here fed by gravity into tubes that run through to the chamber at the other end of the casting. Through these tubes run coarse pitch conveyor worms, ratchet worked from the engine, and these work the coal along the tubes from the hopper chamber.

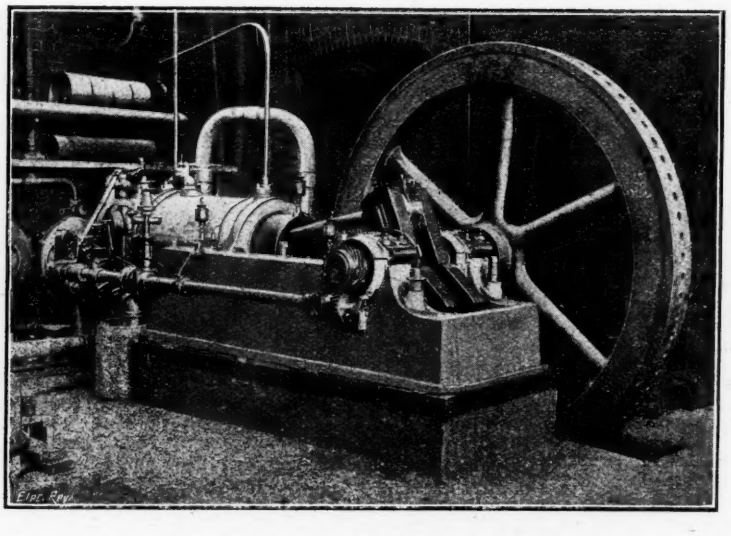
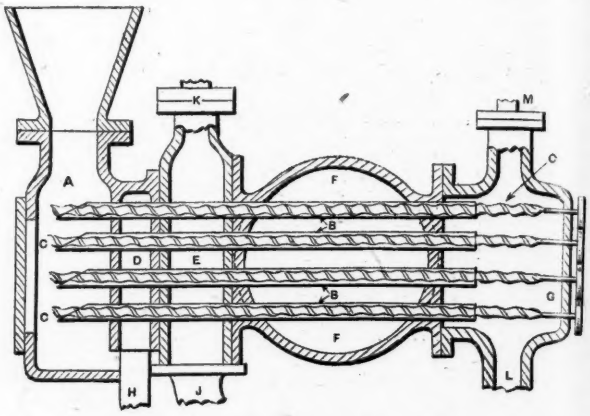


FIG. 1.—GENERAL VIEW OF THE LOW COAL GAS ENGINE.

The engine is started up on ordinary town gas or any other available supply, and after a few minutes' running, these tubes, where they pass through the combustion head and through a chamber heated by the exhaust, become hot enough to raise the coal to incandescence.

The exhaust heated chamber is seen immediately to the left of the cylinder, while on the other side is the shoot chamber, from which the ashes, after being worked to the ends of the tubes, are free to fall into the ash-pit. It will



A, Hopper chamber; B, Gas generating tubes; C, Conveyor worms; D, Chamber where gas is taken off to engine inlet; E, Exhaust heated chamber; F, Cylinder; G, Ash-shoot chamber; H, Pipe to inlet valve; J, Pipe from cylinder exhaust; K, To silencer; L, Ash-shoot; M, Test-cock.

FIG. 2.—DIAGRAMMATIC SKETCH SHOWING THE PRINCIPLE OF THE LOW ENGINE (IN SECTION).

be seen that the ends of the tubes are thus open to the air, which coming up the shoot passes over the incandescent fuel in the tubes and supports combustion.

In the 100-H.P. engine in question, four 2-in. tubes are used, and where they pass through the small space that exists between the hopper and the exhaust heated chamber, they are drilled with as many ½-in. holes as can be conveniently arranged in staggered formation. It is this small chamber that is connected with the engine inlet pipe, the suction from which draws the air and products of combustion to the engine in the form of air gas and coal gas, and this before reaching the engine is mixed with additional air admitted through an automatic valve placed close to the inlet valve. Earlier trials showed irregular running, owing to the pulsating action from the suction of the engine on a plant of such small volume capacity, and thus we find an india-rubber bag, seen in the photo., fig. 1, interposed between the gas plant and the inlet valve to act as a damper and equalise the flow of gas.

The engine is designed for the rather high compression of 90 lb. per sq. in., and this on purpose to give it a wider range of economical power, for though the compression is rather high for working on air gas and coal gas alone, the engine at 90-lb. compression can quite well work on this mixture for a quarter of an hour or 20 minutes. If extra power is required for short periods on emergency loads, 15-18 per cent. more power can be obtained on this dual mixture than when working on the mixture which is obtained by the introduction of water drips into the producer pipes of the gas plant. On the triple mixture compression up to 130 lb. per sq. in. is quite feasible, and it is to permit of extra power from the dual mixture that the compression ratio is compromised at 90 lb.

In normal working the writer noticed that the engine was distinctly smoother in running than when town gas was used, and this can be accounted for by the molecular construction of the hydrogen in the coal gas and water gas being different, the former having a slower rate of combustion. Thus the pressure is well maintained

through the stroke and a good "fat" diagram should be possible. The engine ought to be economical; in fact, judging by what the writer saw in this direction, the inventor will have no difficulty in substantiating his claim of ·5 lb. of coal per B.H.P.-hour—a figure which the writer believes has not hitherto been reached.

Attempts hitherto made to use coal for internal combustion without the addition of elaborate gas making and scrubbing plant, have practically invariably shown a

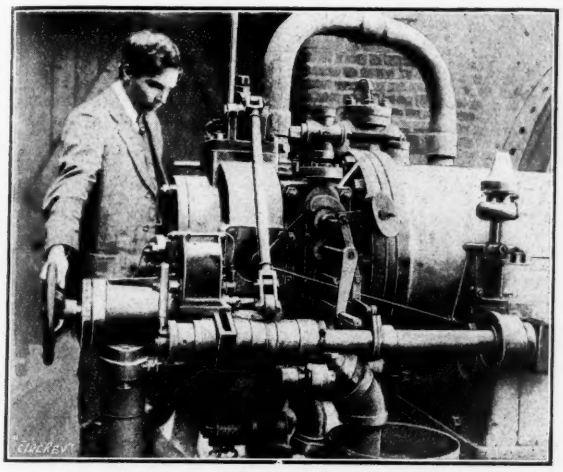


FIG. 3.—CYLINDER HEAD ARRANGEMENT OF THE COAL GAS ENGINE. The figure in the photograph shows Dr. Archibald Low. The valve he is operating changes over the gas from town supply to the self-generated supply.

tendency towards tarry deposit in the cylinder, but in the Low engine this trouble does not appear to exist, for the test cock showed that the gas given to the engine was mixed with a thick mustard-coloured smoke, which would not condense except under extreme cold or a combination of considerable cold and high compression, neither of which would be incurred in ordinary working. The piston, too, appeared to be perfectly free from deposit, although somewhat black, but this was due to the burning of the lubricating oil at the high compressions, and the consequent high temperatures of combustion in the cylinder. In fact, to this last may largely be ascribed the remarkable fuel consumption.

But, apart from the mere economy in fuel consumption, the Low engine promises to have a big future, owing to the simple fact that it utilises the slack and small stuff of our

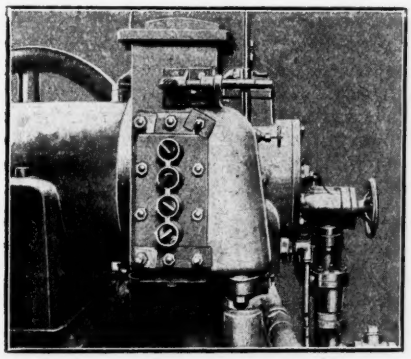


FIG. 4.—COMBUSTION HEAD OF THE LOW ENGINE SEEN FROM THE HOPPER SIDE. The ends of the generating tubes and of the conveyor worms can here be seen.

coal supply—the least valuable grades of coal; nor with the larger size of engine need the coal be screened very carefully. The accompanying illustration will give some idea of the size of the coal used in this comparatively large engine. Of course, the size of the fuel depends to some extent on the size of the engine; for cylinders of about 5 in. diameter with corresponding stroke, cubes up to $\frac{1}{4}$ in. would be quite large enough, while for the little 2-H.P. engine with which Dr. Low did much of his experimental work, the coal was scarcely coarser than coarse brown sugar. That the engine is not very exacting about its fuel supply, however, and has a wide range in this direction is evidenced by the fact that it has been shown capable of running on such fuel as sewage.

One other point. In previous attempts to use coal gas in more direct ways than usual, trouble has often been

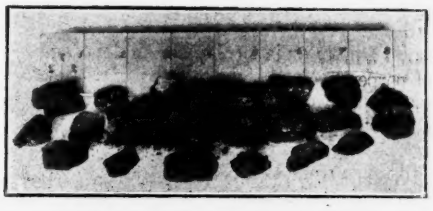


FIG. 5.—GIVING AN IDEA OF THE SIZE AND SORT OF COAL USED ON THE LARGE 100-H.P. LOW ENGINE. The scale shows inches.

experienced from the production of sulphuric acid. In this case the H_2SO_4 is split up into hydrogen, sulphur, and sulphur dioxide, which causes nothing more than a slight pitting of the easily replaceable generator tubes.

The engine has now reached that phase of development when it leaves the experimental, and enters on the commercial stage, and if recent performances afford any criterion, it has a very great future before it, in small and large sizes.

LAYING-OUT ANGLES IN TRANSMISSION LINES.

ONE of the most important preliminary steps in the design of overhead transmission circuits is the determination, surveying and plotting of the route to be followed. The latter must be arranged to take advantage of, or avoid, natural facilities or difficulties, and a certain number of—often very many—deviations have necessarily to be made in the route. It is very important that the angle through which the direction of the line is to be deviated at any point should be rapidly and accurately determined. Methods employing the theodolite and other surveying instruments are well known, but involve costly apparatus and considerable skill and time in their application.

In the course of an interesting discussion which recently ran through several issues of the *Elektrotechnischer Anzeiger*, three very simple methods were described for the determination of line angles. All three methods have been used considerably in practice, and differ little in theory, though one is sometimes more convenient than the others in application. The apparatus required includes only base poles and a 50-ft. measuring tape.

Method 1.—Referring to fig. 1, A B C represents a right-angled triangle with equal sides B A, B C (each = 1·00 to any convenient scale). Suppose the hypothenuse bisected in D and B D joined. The line B D bisects the angle B and is of length = 1 sin 45° = 0·71 (to scale adopted). From B mark out B N, B K, &c., along B D and through N, K draw lines parallel to A C and make B E = B F = 1 = B L = B M, and so on. There is thus obtained a series of isosceles triangles with common apex B.

There exists a definite relationship between the heights and the apex angles of these triangles. As the height varies from 0·71 to 0·00, the apex angle increases from 90° to 180, and every intermediate value of the height corresponds to a definite apex angle, and *vice versâ*.

The chart in fig. 2 consists of a series of such triangles, coapexial at O, and with base apices lying on the circumference of a circle of centre O and radius = 10 (to any convenient scale).

To explain the application of this method, suppose that the angle between A B, B C (fig. 3) has to be determined (in practice the angle between adjacent sections A B, B C of an overhead line lies between 90° and 180°, and fig. 2 has been constructed on the supposition of these limits). Having

erected guide posts at A, B, C, supplementary poles D and E are set in the lines B A, B C, and at a distance of 10 m. from B. The distance D E is measured by a tape, the central point M is thus determined and the distance B M is measured. On setting off B M (to scale) along O P on the chart shown in fig. 2, the apex angle of the corresponding equilateral triangle can be at once read by a protractor, (interpolating between two triangles if necessary). The apex angle thus determined is obviously the required angle A B C in fig. 3.

If desired a more or less complete table of corresponding values of perpendicular height and apex angle can be prepared for the series of triangles in fig. 2, as shown alongside the latter.

Method 2.—Whereas method 1 measured the perpendicular distance from the centre B to the chord A C, E F or L M, &c., fig. 1, the present method regards the angle whose value is required as the angle subtended at the centre B of a

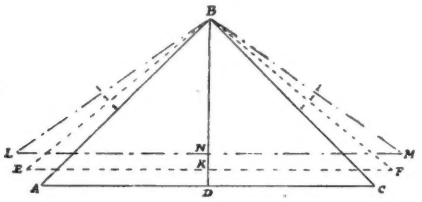


Fig. 1.

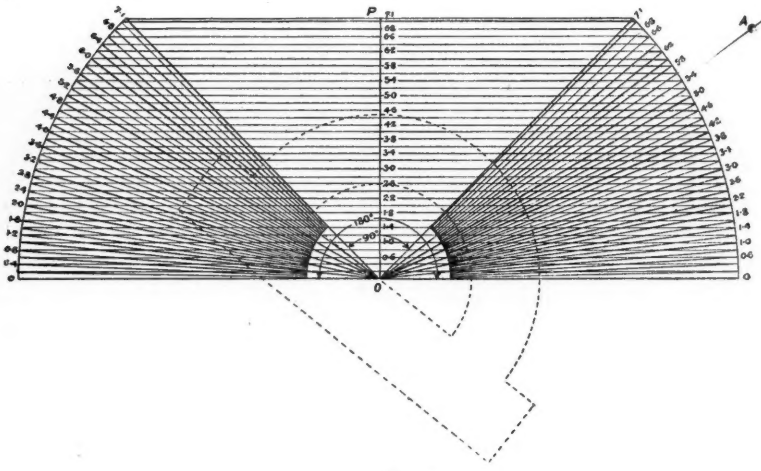


Fig. 2.

circle of radius 10 m. by the chord D E (fig. 3). Setting out posts D, E, as before, the distance D E is measured in metres by tape, divided by 10, and thus a figure obtained from which the corresponding central angle α can be determined by reference to a table of angles and chords (such as is to be found in any engineering pocket book). If the angle α is more than, say, 120°, it is better to set the post D at D^1, then determining the angle β, whence the required angle α at once follows. This procedure is desirable on account of the small changes in the length of the chord D E when α approaches 180°, so that a small error in the chord measurement causes a relatively large error in the angle determination.

As compared with method 1, this method avoids the bisection of D E and the measurement of B M; but, on the other hand, method 1 can be used by reference to a table quite as easily as method 2; and, moreover, the angle α can be determined accurately, however nearly it may equal 180°. Indeed, the accuracy of method 1 rather tends to increase, as the angle α grows larger, for, referring to fig. 4, a given error ($d\,l$) in the height m, subtends a greater chord b when the angle $\alpha/2$ is small, than when this angle is nearly 90°. On the other hand, the error due to ($d\,l$) is never excessive, because the angle α is very rarely, if ever, less than 90° in practice. If, as is probable, the error in m (fig. 4) is a constant percentage, method 1 is yet more accurate in application, since the length ($d\,l$) is less at A (fig. 4) than at B, and hence the angle $d\,\theta^1$ is yet smaller (as compared with $d\,\theta$), than is the case when equal error $d\,l$ occurs in m, m^1.

Method 3.—While depending on the same geometrical foundation as methods 1 and 2, this method evaluates the desired angle by means of a slide rule instead of by reference to tables. It is convenient to determine half the angle α 2, or $\beta/2$ (fig. 3), and make the length B D = B E = B D^1 = 5 yards (or metres) in this case. Referring to fig. 3,

$$\sin\frac{\alpha}{2} = \frac{\text{D E}/2}{5} = \frac{\text{D E}}{10}, \qquad (1)$$

$$\text{or } \sin\frac{\beta}{2} = \frac{\text{E D}^1/2}{5} = \frac{\text{E D}^1}{10}. \qquad (2)$$

Having erected the posts E and D or D^1, and measured the distance D E or E D^1 as before, this length, in yards or metres, is divided by 10, and the result is set on the right-

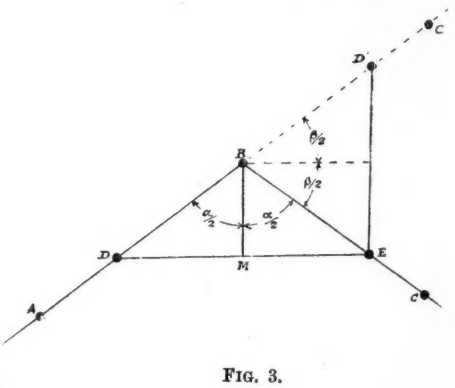


Fig. 3.

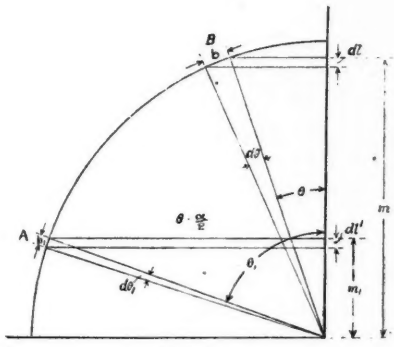


Fig. 4.

hand half of the upper slider, under the right-hand top unit on an ordinary slide rule. The angle $\alpha/2$ or $\beta/2$ can then be at once read on the back of the slider, and double the angle thus determined is α or β, fig. 3.

As is well known, the slide rule does not give sine values accurately above 60°, hence a good working rule is to use equation (1) if the angle α is less than 90°, and equation (2), corresponding to measurement E D^1, if the angle α is greater than 90°, which it usually is in practice.

Table Referring to Fig. 2.—Equivalent Values of m and Angle α.

m.	Angle α°.	m.	Angle α°.	m.	Angle α°.	m.	Angle α°.
0·0	180	1·8	159	3·6	137	5·4	114
0·2	178	2·0	157	3·8	135	5·6	111
0·4	175	2·2	155	4·0	132	5·8	109
0·6	173	2·4	152	4·2	130	6·0	105
0·8	171	2·6	150	4·4	128	6·2	103
1·0	168	2·8	147	4·6	125	6·4	100
1·2	165	3·0	145	4·8	122	6·6	96
1·4	163	3·2	143	5·0	119	6·8	93
1·6	161	3·4	140	5·2	116	7·1	90

Prize Distribution.—The annual prize distribution to the successful students of the Northampton Polytechnic Institute, Clerkenwell, E.C., will be held on Friday, December 6th, at 7.30 p.m. The Marquess of Northampton will distribute the prizes and certificates.

PROCEEDINGS OF INSTITUTIONS.

Scientific Shop Management.

On October 23rd, Mr. G. C. Allingham, A.M.I E.E., read a paper before the Junior Institution of Engineers on the Taylor system of shop management. Discussing present conditions, he pointed out that it was not uncommon for a man to take no less than four times as long over his work as he need do if he did his best. The lack of efficiency was due to the want of means for ascertaining how long it ought to take to do any given piece of work, the tendency of workers to conceal their capabilities, and the inefficient methods of working adopted even by skilled men. Mr. F. W. Taylor and his associates had for 30 years been engaged in a systematic study of manual labour, and had found that, as a rule, work could be done continuously in from one-half to one-quarter the time hitherto expended, and the relationship between employer and employed could be placed on an entirely new basis.

The principle at the root of the system was the analysis of every piece of work into its component parts, and the study of each element, by close observation of first-class workmen. Useless motions were eliminated, others improved; for example, the motions of a bricklayer in laying a brick were reduced from 18 to 5, and in one case from 18 to 2, so that instead of 1,000, he could lay 3,500 bricks per day, with, if anything, less effort than before. Various other instances were cited in the paper, showing, for example, that there was a best size of shovel for handling coal, and another best size for iron ore; even the intervals of rest between carrying heavy loads were subject to correction—with proper intervals of rest and work, nearly four times as much could be done in a day without undue exertion.

In the art of cutting metals, especially, Mr. Taylor's investigations, which comprised some 50,000 experiments at a cost of £30,000 to £40,000, and consumed 400 tons of metal, had led to most valuable results.

The methods adopted were described by the author, who explained also how the rates of payment were fixed so as to enable both workmen and employer to profit by the introduction of the system. For ordinary shop work it was necessary to pay about 30 per cent. above the average current rate of wages; for heavy work, 50 or 60 per cent.; for skilled work, 70 to 80 per cent.; and for work involving both skill and severe exertion, 80 to 100 per cent., above the average. Additional expense was incurred on account of the increased amount of clerical and office work, and more elaborate supervision; but this also was compensated for over and over again by the enormous increase in production, which was not accompanied by a proportionate increase in standing charges. The tendency of the system was to raise the men to a higher class of work than they were on before, and to employ each man on the class of work for which he was best suited. Every man had the chance to do the best he could for himself, and a better chance of getting on than he had previously.

The process of changing to the Taylor system must be gradual; but when once a quarter or a third of the men had been convinced of its advantages by experience, the rest would quickly fall in with it. The system was already in extended use in the United States, where at least 50,000 workmen were employed under it, and in Canada; the output per man had been increased three or fourfold, and the wages by 30 to 100 per cent., but the labour costs were one-half, or less, than they had been even in well-managed works under the old system, with the same plant and equipment. The effect of the system was to raise wages, shorten hours of labour, increase profits, and reduce the selling price, while the workers were benefited not only materially, but also morally. If we were to compete with the United States, we *must* adopt the Taylor system.

Institution of Electrical Engineers (Birmingham Section).

On Wednesday the chairman, Mr. A. M. Taylor, delivered his inaugural address dealing with "Patents and Inventions," on which, he said, the prosperity of the country in general, and of the electrical industry in particular, depended to a greater extent than perhaps was usually supposed. A country which did not provide new developments in industry was apt to stagnate, and would certainly be unable to compete with other countries which were providing these developments.

The question arose whether it was not desirable, in the interests of the country at large, to give still greater stimulus to invention; there was an obvious temptation for large concerns having abundance of capital, and control of certain markets, to seek to use this capital to enhance their profits, and to stifle competition from any new developments.

To take a concrete example: Suppose it had been possible for the manufacturers of reciprocating steam engines to have bought up and stifled all inventions in steam turbines, as rapidly as they appeared; the whole industry of the nation would have suffered, and developments in large power plants would have been retarded to an enormous extent. The destructive tendency of such a course would seem to be self-evident.

One very important reason for the apathy of the capitalist, or the manufacturer, towards the inventor was to be found in the fact that there was a profound distrust in the value of patents, and this was one of the points which it was desired to investigate in the present address.

Another point was the inducement to invention which should be offered by the large firms to their employés, and a third point was the financial assistance which should be offered by independent concerns to the best class of inventors, in the national interest.

Dealing with the first point, it was perhaps not generally known by the inventor that, even when he had survived the scrutiny of the British Patent Office, he had only secured a reasonable chance of his invention not having been anticipated at the Patent Office; he had no assurance that the invention would act in the manner predicted, or that there was real "subject matter" in his invention. The knowledge, in a general way, that there were difficulties of this sort to contend with no doubt had its influence on the capitalist, and even on the manufacturing firms which would otherwise deal with the matter.

A question, then, for careful consideration was whether the inventor got sufficient encouragement from the State to compensate him for these uncertainties, and whether these things were not done better in other countries. In Germany, especially, the investigation of a patent was carried out with a thoroughness that left the inventor, when he emerged successfully through the ordeal, with the confidence that, even if he were attacked in the law courts, his patent would almost certainly not be cancelled either on the ground of lack of "subject matter" or on that of inability to work, if made as described in the specification. Another very good feature about the German patent was that the only fee which the inventor had to pay to obtain this excellent benefit was a matter of some 20 marks, since he did not have to pay the remaining 30 marks unless he was granted the patent, which might be as much as two years later.

The question of the "validity" of a patent, or otherwise, was one of vital importance to the inventor, and the difference between what constituted sufficient to obtain (in England) the grant of a patent and what constituted "subject matter" was little understood by the average engineer.

He would take, for example, the Ilgner patent, which had been granted in this country, and in the pushing of which large sums of money had been incurred, and which, at the instance of a competitor, who had no master patent to offer in its place, was declared to be invalid.

The judgment in this case showed very clearly the erroneousness of the common idea that any combination of known ideas, which effected a new or improved result, was subject matter for a patent. In the present instance the combination of the motor-generator idea (introduced primarily for regulating the speed of the second motor) with the fly-wheel (introduced at the right point of the chain to avoid the excessive demands being transmitted back to the generator) was undoubtedly a combination effecting "a new and improved result," and as such would be accepted by the British Patent Office. But after a company had been formed, and capital spent on developing the scheme, with the supposed certainty of reaping a substantial reward later in royalties, the whole thing was quashed by an action in the law courts.

What, then, could be done for the inventor? Undoubtedly the right way was for the British Patent Office to be invested with powers to enable it to determine authoritatively whether an invention possessed "subject matter" before it issued Letters Patent.

It seemed to him that the British inventor had for too long neglected to avail himself of the means of combination possessed by other individuals, and some powerful organisation was needed in this country to defend his interests, and to state his case in Parliament. Something, in fact, akin to their own Institution was needed.

He might perhaps give a hint to the inventor. If he could not get the British Office routine amended in the desired direction, the German Patent Office was still at his disposal, and the "oracle" could be worked, if done the right way, for a sum not exceeding £3 to £4 if the patentee was his own draughtsman.

Turning to the inducements to invention offered by manufacturers, it was fairly common practice for large manufacturing firms to call upon their employés to sign a document, whereby they agreed to hand over absolutely to the firm all inventions they might make while in their service, and disclaimed any right whatever to participation in the profits. The theory of this arbitrary proceeding was that the employé had got his knowledge through his employer. But, though there were occasional cases where the invention had, so to speak, been pitchforked into the employé's hands in the course of his daily work, there was a large majority of cases where the employé came to the employer with knowledge gained elsewhere, and to the benefit of which the employer was not entitled.

A case happened within his own knowledge, where an exceptionally brilliant engineer was positively dismissed because he refused to hand over to his employers a patent which he had taken out, and the knowledge for which he had certainly obtained before he came to the said employers.

No doubt there were many simple ideas which were the result of a happy inspiration in the course of one's daily work; but the day had gone by when anything of real value could be evolved in electrical engineering without an immense amount of brain work; and, if there were not sufficient stimulus of reward, the busy engineer could hardly be expected to spend his evenings at such problems when he could get along just as well with his employers if he did not do anything outside of his office.

There were certain fairly obvious improvements which might be made in present relations between employer and employé.

It should be absolutely illegal for an employer to compel an employé to hand over to him his invention, on pain either of dismissal, or of prejudice in any way to his advancement if he stayed on with the firm employing him.

The employé should certainly be allowed to apply direct to the Patent Office in the first instance, if he chose to do so. The fact that the patenting fees were, under present arrangements, borne by

the employer, counted for very little in the matter. In most cases the inventor would greatly prefer to pay his own.

In all these matters an Institute of Inventors might be of inestimable service to the inventor, if properly arranged to safeguard his interests.

Undoubtedly the engineer with a genuine bent for invention needed every encouragement. By this he did not mean the casual inventor of a new button-hook or boot-jack, but the engineer who, having a good training in fundamental principles, set out with a full knowledge of what had already been accomplished in a particular direction, and had a clear idea of what he wanted to arrive at, and was prepared to make sacrifices in its attainment.

Could not the Institution do something in this sense? All their premiums appeared to be granted on the merits of papers read before the Institution, judged on the basis of their contribution to the general fund of knowledge, or their promotion of a good discussion. But if they had a substantial premium set aside for the inventor who might read a paper descriptive of his work (even if the object of that work were not finally attained), such premium might help him to continue his experiments or developments. And, if contributions towards such a fund were invited on the part of members generally, would there not probably be a large response from members, and thus an additional stimulus given to original work?

The period of six months allowed between the lodging of the provisional and that of the "complete" specification was altogether too short for inventions that involved a great deal of investigation, calculation, experiment and development.

It was very hard on the class of inventors who were the most likely materially to benefit their country that they should be handicapped by having either to drop their original work (and thus lose priority) or to disclose to the public an invention at such a stage that it invited development by others who had not done the really hard work on it. They should be allowed, under increasing penalty, to extend the time to nine months, or even a year.

A suggestion might be made as to whether the British Patent Law should not differentiate between "inventions" in which there was held to be "subject matter" and those in which there was not. There was a large class of very useful inventions in which two or more independent ideas were combined to produce a new and improved result. Surely such an invention deserved better of the public than to be put upon the scrap heap after a lot of time and money had been spent upon it. Take, for instance, the Ilgner case; it was very easy for a judge to be persuaded by expert witnesses that the thing was self-obvious, but the ordinary engineer might be allowed to have his doubts about this.

In any case the fact remained that the crushing of a patent in this way was a distinct discouragement to invention, and that the best class of inventor, viz., the well-informed, plodding engineer, who had a definite purpose and the best equipment for effecting it, was the one most hard hit by it. He would suggest that complete protection be granted to this class of patent, but only, however, for a limited term of years—say 10 years instead of 14 years. Anything which discouraged inventions which would confer a boon upon the country producing them (though they need not be in themselves of striking novelty) was actually a blow aimed at the trade of the country itself, and therefore should be remedied with the least possible delay.

An Improved Joule Radiometer.

On the 8th inst. Mr. F. W. Jordan, A.R.C.S., B.Sc., described before the Physical Society an improved form of his simple Joule apparatus, adapted to show the existence of the Peltier and Thomson effects, which had been designed to eliminate the necessity of elaborate thermal insulation and to give a steady zero and a fairly high sensibility.

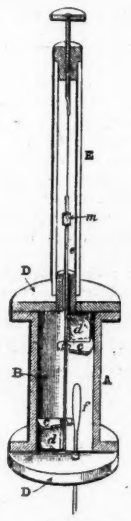
A brass tube A, 4 cm. long, 1·6 cm. diameter and 0·2 cm. thick, was divided longitudinally into two compartments by a copper plate B, 0·6 mm. thick. Two rectangular gaps were cut in diagonally opposite corners of the partition and two sector-shaped disks of copper, *c c*, were soldered to the edges of the gaps to form the horizontal sides of the channels for the current of air between the compartments. The partition B and the disks *c c* were soldered to the inner surface of the brass tube A. Two light mica vanes, *d d*, each 7 mm. × 6·5 mm., and total weight 1·4 mgm., were fixed with a little shellac to a fine glass stem *e*. The distance between the vanes and the other dimensions were arranged so that when suspended the clearance between the edges of the vanes and the sides of the channel was about 1 mm. A small silvered glass mirror *m*, 3·5 × 2·5 × 0·2 mm., was attached to the glass stem *e*, and the whole system was suspended by a quartz fibre 9 cm. long and about 0·004 mm. in diameter. The flanged ends of the brass tube A and the brass cover plates D D were ground plane and screwed together tightly. The glass tube E carrying the torsion head was fitted over a short brass tube fixed centrally to the upper cover plate. The motion of the vanes was limited by stops to about 20°. The air in the interior of the apparatus was thus practically sealed from communication with the atmosphere, and shielded from stray heat by the brass enclosure. The apparatus was fitted inside a concentric brass tube, and the whole was mounted on a levelling stand.

The sensibility of an instrument of this type might be expressed by the deflection in millimetres on a scale at a distance of a metre from the mirror produced by the absorption or evolution of heat at the rate of a microwatt in one of the compartments. This was determined by passing a measured current through a known resistance in one of the compartments.

The ends of a short length of No. 47 eureka wire *f* were soldered to two leads of No. 36 copper wire. The insulated leads were fastened together and to the inside of a narrow glass tube with paraffin wax. The glass tube was passed through a circular aperture in the lower cover plate, and sealed with Chatterton compound; a pair of dummy leads were similarly mounted in the other compartment to compensate any gain or loss of heat along the leads to the resistance loop.

The position of the spot of light on the scale was steady a few minutes after the apparatus had been levelled and adjusted. Bringing the hand quite near to the outer brass tube had no appreciable effect, and the zero remained steady to within a fraction of a millimetre. The motion of the vanes was excessively damped, and the period of swing was much greater than the undamped natural period.

The deflections produced by measured currents through the resistance loop were very nearly proportional to the squares of the currents. In the case of the full scale deflection the spot of



New Radiometer.

light became steady 40 seconds after the current was started through the resistance. On breaking the current the spot of light returned to the original zero in about the same interval of time. This interval of time could be reduced by diminishing the air resistance to the motion of the vanes. The latter could be effected by increasing the clearance around the edges of the vanes. The following figures gave some idea of the sensibility of the instrument.

A deflection of 122 mm. on a scale at a distance of a metre from the mirror was produced by a current of 4·75 milliamperes through the resistance of 10·5 ohms. This gave a sensibility of 0·52 mm. per microwatt. The small deflection of about 1 mm. produced by 0·5 milliampere could be repeatedly observed. The range of the instrument could be extended to measure feeble alternating currents of the order of 10^{-4} amperes by using a heater of 1,000 ohms, and the least detectable current in this case would be 5×10^{-5} amperes.

Alternating currents producing more than the full scale deflection could be conveniently and accurately measured by the compensation methods of H. L. Callendar and K. Angström. In Callendar's method the heat from the heater would be absorbed by the current through a thermo-junction in the same compartment. In Angström's method the heat would be balanced by the heat from a similar resistance in the other compartment. A calibration with direct currents would be necessary in every case to measure alternating currents.

The instrument might be adapted to measure the heat given out by small quantities of radium. A calculation showed that 1 mgm. of radium should give a deflection of 50 mm. on the scale.

To measure radiant heat it would be sufficient for most purposes to make a small window of rock salt or fluorite of about 50 sq. mm. in the side of the brass tube A and direct the radiant heat on to a thin metal disk supported centrally by a fibre in one of the compartments. The rate of absorption of heat by the disk could be measured by Callendar's method. The indications of the instrument could thus be made independent of radiant heat from directions other than those limited by a tube directed towards the window and the receiving disk.

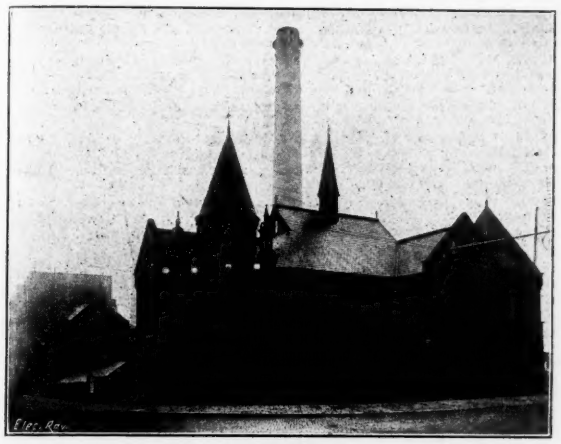
Australian Sign.—A novel sign has recently been erected in Kingsway for the Australian Commonwealth. It is illuminated by 156 Osram lamps, which give it a brilliancy enabling the daily messages displayed thereon to be read at a considerable distance. The light is well directed and concentrated by means of hidden reflectors. The electrical work in connection with this sign has been carried out by the Electrical Installations, Ltd., of 27, Martin's Lane, Cannon Street, E.C.

SOME CARLISLE NOTES.

Readers of our pages will be aware that recently a very successful electrical exhibition was held by the Carlisle electricity department, in the main hall of what was a Unitarian Church building, until it was acquired by the Corporation for necessary extensions of the electricity works.

During the past three years the capacity of the works has been trebled, mainly in order to cope with the growing motor load in the city.

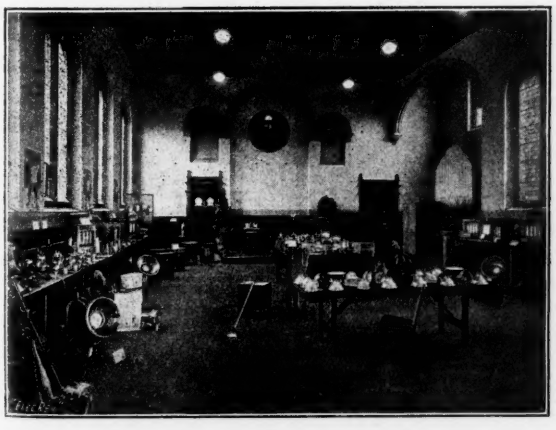
This has considerably improved the conditions at the works, and greatly reduced the works costs, making it possible to offer supplies at cheaper rates, and as a result, and with a view to increasing the meagre revenue obtained from mains laid in residential districts, Mr. S. T. Allen, the city electrical engineer, was led to introduce



Church Buildings Purchased for Extensions by Carlisle Electricity Department.

the new "domestic" tariff based on a fixed charge of 12½ per cent. of the annual net rateable value of the house, and ½d. per unit for all energy consumed for lighting, heating, or cooking. The fixed charge is, moreover, payable quarterly, and no meter rents are charged.

In order to bring the advantages of this tariff home to existing and potential consumers, and more particularly to emphasise the value of electric cooking, Mr. Allen decided that it was preferable to hold the exhibition previously mentioned, and, further, that the latter would best achieve its purpose, if personal invitations, in the form of cyclostyled letters, accompanied by complimentary tickets



Church Hall Used for an Electrical Exhibition at Carlisle.

were sent to specified individuals. The exhibition was not intended to amuse the man in the street, but rather to concentrate attention on modern domestic apparatus, and it drew an attendance of 1,200 to witness the demonstrations of cooking, ironing, &c. Cooking was carried on nearly all day for about five days, and no attempt was made to ventilate the hall, a feature which was impressed on crowded audiences, and demonstrated the purity of the air under the abnormal conditions prevailing.

Invitations were extended to visitors to bring their own joints to be cooked, and they were asked to weigh them both before and after, so that they could prove for themselves the great saving in weight when meat is cooked electrically. A large variety of heating apparatus, irons, kettles, hot-plates, vacuum cleaners and lighting apparatus was on view, and local contractors were invited to make full use of the exhibition and its contents, there being no other showroom in the town. Full advantage was taken of this, and although little was sold directly by the Corporation, which has full powers to sell or hire, a good deal of business was done from outside.

The exhibition was primarily held for the purpose of familiarising consumers with the extended uses of electricity rendered possible by the new domestic tariff, and we gather that the Carlisle Electricity Department is experiencing a busy time as the result.

For one thing, a hire-purchase wiring system between landlord and tenant has been introduced, under which the Corporation obtains tenders for the wiring work only, and the tenant pays for the work in the first instance, but only after agreeing with the landlord that the latter shall deduct from the rent 20 per cent. a year for five years, of the cost of wiring alone.

By this arrangement the landlord pays for the wiring work by instalments and without interest charges, *if* the tenant remains five years; if the latter leaves before that period he sacrifices part of the cost which he originally paid.

The exhibition hall, or part of it, will be permanently used as a showroom by the Electricity Department, which intends to make use of part of the rather secular-looking church building for a battery room, stores and further office accommodation. In conclusion, we are indebted to Mr. S. T. Allen for the interesting notes here printed.

CONSULAR NOTES.

Bosnia.—The British Consul at Sarajevo reports an opening in Bosnia for British-made steam engines, and oil and benzine motors for driving threshing machines and flour mills. H.M. Consul also states that dealers in Sarajevo now apply to his Consulate more frequently than they used to do with the object of getting into direct communication with British firms. The names of such persons are communicated to the Commercial Intelligence Branch of the Board of Trade. Inquiries made of leading merchants seem to show that, on the whole, the demand for British goods is increasing steadily, though the total consumption is still very small—perhaps not over £10,000 worth per year.

The erection of a large new general post office, in which the postal, telegraph and telephone services will be centralised, was begun in 1911, and is to be completed by 1913. The cost is estimated at £47,000. The electric tramway system is to be extended, and a more frequent service introduced. The following works are being contemplated for other towns in Bosnia-Herzegovina:—Banjaluka, electric lighting; Bihac, electric lighting; Bijeljina, electric lighting; Derventa, electric lighting and drainage; Mostar, public baths, £12,500; bridge over the river Narenta, £9,000; electric power station; slaughter-house; Zenica, electric lighting and drainage.

Chile.—The British Consul-General gives the following list of wireless telegraph stations in Chile in a report recently sent home:—

Stations.	Radius. Kiloms.	Remarks.
Arica	600	To be completed next year
Antofagasta	600	" " "
Coquimbo	600	" " "
Valparaiso	600	Now working
Juan Fernandez ..	600	Projected
Talcahuano	1,200	To be completed end of this year
Mocha	600	" " "
Llanquihue	2,000	Projected
Ancud	600	"
Huafo	600	"
Cabo Raper	600	"
Evanjelistas	600	"
Punta Arenas	2,000	"

Note.—All stations, with the exception of Talcahuano, will be fitted with the Marconi apparatus. Talcahuano will have the Telefunken system. All stations will maintain a permanent service day and night.

Russia.—The British Consul at Moscow reports that owing to the appearance of a new competitor who threatened their monopoly, the Moscow Electric Co. considerably lowered their rates during 1910. The result of this was that many mills and works in Moscow started using electricity for their motive power and lighting. In the Lefort district of Moscow alone out of 48 factories 20 have already adopted electricity, and others are following their example. The works find not only that electricity is cheaper, but also from a hygienic point of view much is gained, and there is less danger to the hands.

Tasmania.—The American Consul at Hobart reports that by the 1st of January of next year, Hobart and small near-by towns will be supplied with cheap electric current for lighting and power purposes derived from the water-power resources, and this ought to stimulate a demand for electrical materials and apparatus, of which American manufacturers might take advantage. The city of Launceston, which now has a limited supply of cheap electric power, will doubtless have larger supplies available in the near future, and it seems only a matter of time when probably most of the towns of Tasmania will be electrically developed. The estimated cost of providing the installation and of erecting some metallurgical works in connection therewith is £250,000. The company expects later on to use the electric power not only for the treatment of complex Australian ores, but also for the manufacture of calcium carbide, calcium cyanamide, &c.

Japan.—The American Consul at Yokohama reports that the Japanese Government has rejected the application of the municipal authorities of Tokio for permission to increase the capacity of the electric light department of the city to approximately one million lights. The Municipality of Tokio is now engaged in the lighting business through the ownership of the electric street-railway lines. The Tokio Asahi states that the reason for rejecting the application is that, when the establishment of the Nippon Electric Light Co., came up for approval last year, the Government, after investigation, ascertained that there was ample room for the operations of three companies—the Tokio Electric Light, the Nippon Electric Light, and the Electric Light Department of the Tokio Railways (now the Electric Bureau of the Tokio municipality)—and granted the Nippon Electric Light Co. the right to furnish electric light to the amount of 11,000 KW. If the Government were now to sanction the new scheme of the Tokio municipality for 17,000 KW. (or actually 20,000 KW.), despite the fact that there has been no particular increase in the demand for electric light in the city, the grant to the Nippon Electric Light Co. would become meaningless.

Venezuela.—The American Consul at La Guaira reports that the telegraphic system of the Government has been extended to Ocumare de la Costa, the point between the La Guaira and Puerto Cabello, toward which the new road from the interior is being constructed. During April the duplex system of telegraphy was established on several of the principal lines of the Government, and this system will be extended to the following places: Maracaibo, Barquisimeto, Trujillo, Merida, Rio Chico and Cumana. The Ministry of Fomento has been authorised to purchase the necessary instruments for the service and to construct direct lines between Trujillo and Valera and between Rio Chico and Cumana.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

FRANCE.—The British Chamber of Commerce in its Monthly Circular calls the attention of British manufacturers and exporters to the fact that French law prohibits the "import, bonding, transit or circulation of all foreign products, natural or manufactured, bearing on themselves or upon their packing cases, bales, envelopes, bands or tickets, &c., any trade or manufacturer's mark, name, sign or indication whatsoever which may cause the belief that such goods are of French make or origin." It is, says the Circular, in the interests of British manufacturers to emphasise in every way the British origin of their goods, and they usually do so, but it occasionally happens that a French customer wishes his name to appear on the goods he orders. Compliance with such a request would involve the seizure of the goods at the port of entry, unless the mark were accompanied by the words "importé d'Angleterre" or "fabriqué en Angleterre," and the same remark applies to any mark or indication whatsoever which is in the slightest degree likely to cause the belief that the goods are French. Even in the case of British firms having branches in France and marking their goods thus—"J. Smith & Son, London and Paris"—such marking would be held to be an infringement of this law unless the mark were accompanied by an indication in French of the real country of origin as above. The Circular draws particular attention to this matter, as the French Customs authorities are said to have made a great number of seizures of goods recently for the above-mentioned reasons, and it further advises British exporters to avoid possible trouble by indicating the British origin of their goods in the most distinct and unmistakable way; and, in the case of firms having a branch in France, to indicate the British origin of their goods, not only upon the goods themselves, but also upon their general office stationery.

TURKEY.—As a result of the war, all goods sent to Turkey from neutral countries must be accompanied by a certificate of origin; if not, such goods will be charged with extra duty of 100 per cent., as well as ordinary duty of 11 per cent. *ad val.*

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,586. "Electric oven." SIMPLEX CONDUITS, LTD., and F. G. TAYLOR. October 28th.

24,592. "Means for and methods of changing the frequency of alternating currents." A. M. TAYLOR. October 28th.

24,596. "Box or packing for electric light bulbs and the like." H. W. BURBURY, E. N. HILLIER and W. A. THOMPSON. October 28th.

24,618. "Power transmission." J. G. P. THOMAS and THOMAS TRANSMISSION, LTD. October 28th.

24,621. "Electric incandescent lamps." H. BARTA. October 28th.

24,626. "Crucibles for electric furnaces." MORGAN CRUCIBLE CO., LTD., and C. W. SPEIRS. October 28th.

24,643. "Electromagnetic separators." MASCHINENBAU-ANSTALT HUMBOLT. (Convention date, October 27th, 1911, Germany.) October 28th. (Complete.)

24,665. "Devices for automatically adjusting the time of ignition in internal-combustion engines." FIRM OF R. BOSCH. (Convention date, December 6th, 1911. Germany.) October 28th. (Complete.)

24,691. "Driving gear for the armature shafts of magnetic igniting apparatus for internal-combustion engines." S. K. THORESEN and O. R. OLSEN. October 28th. (Complete.)

24,718. "Homopolar dynamos." A. ROLFE. October 29th.

24,733. "Electrically controlled locks for securing the doors of railway carriages, taxicabs, or like vehicles when in motion." C. B. MACADAM and J. JAMES. October 29th.

24,751. "Electrical transmitting and receiving devices for communication simultaneous and equal movements." J. L. ROUTIN. October 29th.

24,758. "Method for the transmission of photographs and other pictures by means of ordinary telegraph and telephone apparatus." U. ELLERO. October 29th. (Complete.)

24,776. "Electrical heating units." E. C. R. MARKS. (Landers, Frary and Clark, United States.) (Divided application on 10,029 of 1912, April 27th.) October 29th. (Complete.)

24,810. "Electric heating stoves." S. L. KILPIN. October 29th.

24,875. "Incandescing bodies." C. H. FISCHER and R. ZIMMERMANN. (Convention date, December 13th, 1911, Germany.) October 30th. (Complete.)

24,898. "Dynamo-electric machines." A. ROLFE. October 31st.

24,927. "Device for winding and unwinding line wire, chiefly as transmitter of electric current to a varying length." F. J. G. BEYER. October 31st.

24,932. "Switches." J. LIDDLE. (Gordon Electric and Manufacturing Co., United States.) October 31st. (Complete.)

24,937. "Production of high-frequency currents adapted for use in wireless telegraphy and telephony." W. P. THOMPSON. (Compagnie Universelle de Telegraphie et de Telephonie sans fil, France.) October 31st. (Complete.)

24,951. "Electric motors used in the propulsion of vehicles." W. H. ALLEN. October 31st.

24,953. "Fittings for electric lighting purposes." F. A. WILKINSON. October 31st.

24,954. "Electricity meter." L. SCHÖLLER. (Convention date, April 30th, 1912, Germany.) October 31st. (Complete.)

24,960. "Apparatus for periodically testing electric currents." C. SMITH. October 31st.

24,968. "Arc lamp carbon-holder." A. M. HOOPER. October 31st.

24,971. "Electric candle lamps." H. GARDE. October 31st.

24,999. "Pole or standard for wireless telegraphy." H. W. MUGLESTON. October 31st.

25,028. "Mariners' compass." W. D. WHYTE. November 1st.

25,052. "Tungsten anti-cathode for Rontgen tubes." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges. Germany). November 1st. (Complete.)

25,090. "Lead alloys." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) November 1st. (Complete.)

25,091. "Azimuth fitting for a mariner's compass." J. G. COWIE. November 1st.

25,096. "Portable self-contained vulcanisers." W. H. WELCH and H. FROST AND CO., LTD. November 1st.

25,101. "High-tension electrometers." H. BAUER. November 1st. (Complete.)

25,104. "Electric heating of houses." H. LOFQUIST. November 1st. (Complete.)

25,139. "Couplings for electrical purposes." V. C. H. GIBSON. November 2nd.

25,174. "Telephone exchange systems." F. R. MCBERTY. (Convention date, November 3rd, 1911, United States.) November 2nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

MANUFACTURE OF INSULATED ELECTRIC LEADS OR CABLES. F. H. Broomfield and E. H. Tawn. 21,834. September 27th.

PORTABLE ELECTRIC SIGNAL LAMPS. A. J. Stevens and A. J. Lyon. 22,426. October 11th.

ELECTROMAGNETIC MEANS FOR THE TRANSMISSION OF POWER. J. G. Balsillie. (Balsillie.) 22,690. October 14th.

SELF-STARTERS FOR EXPLOSION ENGINES. N. A. Christensen and A. J. Boult. 22,710. October 16th. (Addition to 15,471 of 1911.)

FIELD TELEPHONE AND TELEGRAPH SET. A. J. Stevens. 23,172. October 20th.

HOLDERS FOR TELEPHONE RECEIVERS. J. Trenner. 23,314. October 23rd.

ELECTRICAL INSULATORS. J. H. Ellis and British Insulated and Helsby Cables, Ltd. 23,663. October 26th.

ELECTRIC LAMPS FOR MOTOR VEHICLES AND THE LIKE. A. J. Bonnella. 23,713. October 2 th.

MEANS FOR INCREASING THE POWER-FACTOR AND OVERLOAD CAPACITY OF ALTERNATING-CURRENT SYNCHRONOUS MACHINES. G. Kapp. 24,823. November 7th. (Cognate application, 741 of 1912.)

ELECTRIC POWER TIMBER BAND-SAW MACHINES. G. Pickles. 25,517. November 16th.

MAGNETIC BRAKES OF TRAMCARS AND LIKE VEHICLES. G J. Conaty and C. B. Ketley. 26,969. December 2nd. Cognate applications, 7a3 of 1912 and 3,091 of 1912.)

1912.

ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co.) 469. January 5th.

LIGHT PROJECTING APPARATUS AND THE LIKE. J. T. Roffy. 506. January 6th.

ELECTROLYSIS OF METALLIC SALT SOLUTIONS. N. V. Hybinette. 771. January 10th. (January 19th, 1911.)

COMBINED ELECTRIC WIRE CONNECTION AND CORD GRIP. G. St. J. Day. 1,305. January 16th.

SUSPENDERS FOR OVERHEAD ELECTRIC CABLES. C. E. Elder. 4,975. February 28th.

ELECTRIC MOTOR CONTROL SYSTEMS. Allgemeine Elektricitäts-Ges. 5,869. March 7th. (March 7th, 1911.)

ELECTRICALLY-PROPELLED MOTOR-CARS. Allmanna Svenska Elektriska Akt. Bolaget. 7,994. April 2nd. (April 12th, 1911.)

ELECTRICAL DUST SUCTION APPARATUS. Firm of Bunte & Remmler. 10,605. May 4th. (July 3rd, 1911.)

ELECTRIC HEATING APPARATUS. A. F. Berry. 13,861. June 13th. (December 28th, 1911.)

ELECTRIC SWITCHES. E. B. Merriam. 14,751. June 24th. (June 23rd, 1911.)

TELEGRAPHIC RELAYS. A. Muirhead and F. L. Muirhead. 17,955. August 2nd.